THE

ELECTRICAL REVIEW.

VOL. LXV. OCTOBER 22, 1909. No. 1,665.

ELECTRICAL REVIEW.

Vol. LXV.] CONTENTS: October 22, 1909. [No. 1,665

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE UNIVERSAL ELECTRICAL DIRECTORY.

(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E C.

THE POSSIBILITIES OF THE ELECTRIC VEHICLE.

THE more one ponders over the position of the electric vehicle in this country, the more certain it appears that some drastic treatment is required for the species of "sleeping sickness" which has, apparently, settled on this particular form of locomotion.

Probably, however, the position is not generally realised. Many of us are accustomed to a feeling of chagrin when we see smoking factory chimneys, especially new ones, hard at work within a stone's throw of a central station; we feel that something is wrong. Yet, curiously enough, there are very few of us who do not treat the remarkable absence of electric vehicles from the streets of our large cities as quite a matter of course.

If we are not mistaken, the electric vehicle suffers in this country only from lack of enterprise, such feeble efforts as have from time to time been made by the makers of these cars having met with no encouragement from the central station engineers, who have everything to gain, and having been absolutely swamped by the propaganda of the petrol car maker.

Yet for city work in congested districts, the simple, noiseless, easily operated and repaired electric car has an undeniable advantage over any other type of vehicle on the street—especially with the present trend of taxation towards its rivals. For some indication as to what may be accomplished by a little pushing, one turns to the United States, where the electricity supply companies in New York, Chicago, Philadelphia, Boston and other centres have come to regard the electric vehicle as equally worthy of attention with the motor, radiator, flatiron, &c.

It is estimated that fully 10,000 electric cars are now in use in the States; New York City claims the largest number of commercial electric vehicles in use, the number being about 1,000, and Chicago claims similar honours as regards pleasure vehicles with some 3,000 in service.

Los Angeles and neighbourhood boasts 575 electric cars, and Brooklyn 300, of which one delivery company operates 40. In the case of Los Angeles, Mr. W. J. Gramba, in a recent Convention paper, stated that the rate for energy for battery charging varied from 2 to 6 cents per KW.-hour; in private garages the average income per month per vehicle was $5, and the total monthly income from public garages—the details per vehicle not being available—was from $50 to $200 per garage. Mr. Gramba considered that it was reasonable to estimate a yearly income of $19,500 from the electric vehicles in Los Angeles.

Mr. J. T. Hutchins, dealing with the electric vehicle business of the Rochester Electric Supply Co., said that the sales of energy for battery charging had increased from 285,470 units in 1906 to 495,490 units in 1908, or by 73 per cent., and the income correspondingly from

$12,458·91 to $19,796·56, or by 56 per cent. Some explanation of this improvement is found in the fact that the Rochester company has an organised department looking after this class of business, which takes particular care of the vehicle owners, and assists them in every possible way.

In the case of the Brooklyn Edison Electric Illuminating Co., the services of a battery expert have been retained, with a view to educating and instructing the users of electric vehicles in the care of their batteries.

As showing the progress made in commercial vehicles in America, a few years ago a 1,000-lb. load-car weighed complete 4,850 lb., and ran 25 miles at a cost of $0·036 per mile; now a similar car is in use weighing only 3,240 lb., and running 40 miles at a cost of $0·011 per mile.

At the same Convention, some specific examples of the use of electric delivery vans were given. Thus one two-ton truck replaced two two-horse trucks working 12 months, and one additional two-horse truck during the winter months; the cost of horse haulage for two years was $9,325, while the cost of the electric truck over 2½ years was :—

Energy, tires, driver, maintenance	$3,937
Interest on cost	690
Depreciation (25 per cent.)...	1,285

or a total of $5,912, showing a saving on the longer period of $3,413.

A St. Louis Brewery saved 50 per cent. on haulage by adopting electric wagons; this concern has 50 wagons in service after six years' experience of their use.

The records of the express delivery companies show for ½ ton wagons, daily mileages of from 30 to 50, making from 30 to 175 stops; and for 2-ton wagons, daily mileages of 32 to 47 miles with 125 to 180 stops.

The comparisons are, of course, mainly with the horse-drawn vehicles which encumber the streets of cities and towns.

Now, the fact that our American cousins can, and do, successfully employ the electric vehicle cannot be put down to any inherent difference between the characteristics of the two countries; it is simply a case of lethargy here and enthusiasm there. In the States, the vehicle maker, battery maker, motor maker, and tire maker, all boom the electric vehicle, hand in hand with the central-station authorities and assured of their co-operation. In this country the electric vehicle maker is scarcely known—possibly as a result of the scant encouragement he has received; the central-station authorities, intent on bettering their day loads by popularising power, heating, ventilating and cooking devices—all excellent in their way—have apparently forgotten the great possibilities of the midnight and early morning load which the charging of battery vehicles can very well give them, and overlooked the fact that, as an American contemporary puts it, "an automobile uses more current for its storage batteries in one month than a cigar lighter does in 10 years."

Some central station engineers fully appreciate the fact that they must sell light, heat, motive power, &c., and that their business by no means ends at the consumers' meters, as the commercial departments which operate in conjunction with their undertakings bear witness; it is, therefore, but a step further to add the electric vehicle to the list of electrical appliances, for we may be sure that electrical vehicle makers will not stand in the way.

Indeed, with the relations at present existing between the London supply undertakings, municipal and company, it should not be either difficult or individually expensive to impress upon the London public the possibilities of the electric car, by means of a striking co-operative exhibit at the large motor shows—in which the vehicle maker would no doubt assist.

Many engineers have with commendable discretion offered favourable terms to day-load consumers who agree to keep off the peak load, and with successful results; they would doubtless be equally glad to give even more favourable terms to garages and charging stations for supplies between midnight and 6 a.m., when their plant is practically idle.

But even favourable rates and vigorous publicity will not wholly meet the case; the various supply undertakings must show faith in their wares, and themselves use the electric vehicle where they now adopt the petrol car—in fact, the various Corporation departments offer a good field for preliminary work.

Once the central-station engineers grasp the problem, they will probably realise that to use a petrol car for city work is very much on a par with lighting the electricity works by gas.

Investments in Electrical Undertakings.

The electrical industry in this country is generally accepted as offering few attractions to investors, and some figures appearing in the September issue of *The Investors' Monthly Manual* draws a comparison between investments of different classes, which is of interest.

In this article arguments are put forward both in favour of and against the policy of confining investments to one particular class of security; and an example is taken of an individual having invested £10,000 ten years ago in different forms of security, and the market value of his securities in 1898 and 1908 is given.

From the figures given below, which are extracted from the article in question, it will be seen that the investor who selected electrical securities would have found that his securities had depreciated during the ten years in question to a greater extent than the other securities dealt with. British railways came next in full value.

It will be seen that the fall in capital value in the electrical investments during the ten years in question was from £10,000 to £4,970; British railways fell from £10,000 to £6,409; telegraphs and telephones rose from £10,000 to £10,582; and foreign railways rose from £10,000 to £20,769.

The electrical investments referred to are these :—

Securities.	Value 1898.	Value now.	Difference.
Charing Cross, West End and City	£1,000	£324	— £676
City of London	1,000	411	— 589
County of London	1,000	563	— 437
London Electric Supply	1,000	586	— 414
South London Electric	1,000	523	— 477
Westminster Electric	1,000	424	— 576
British Electric Traction ...	1,000	43	— 957
Dublin United Tramways ...	1,000	688	— 312
Provincial Tramways	1,000	667	— 333
City of Birmingham Tramways	1,000	741	— 259
	£10,000	£4,970	—£5,030

At first sight it would be assumed that the electrical securities selected for investment must have been of an abnormally precarious nature, but on examination it cannot be said that these securities would have presented themselves as of a doubtful character when the investment was made ten years ago, and the heavy fall in capital value can only be stated to be an indication of the unsatisfactory state of the electrical industry from an investor's point of view. There are of course, as our readers are aware, many reasons for this. A number of the companies are those which were depressed for years by the London Power Bill controversy, and at the last meetings of some of these the consequent enormous depreciation in market values was referred to in detail. But the phenomenal depreciation shown in B.E.T.'s is not to any large extent due to that cause.

It might further be stated that the electrical investments in question, confined as they are to investments outside the manufacturing industry, might be called the "cream" of electrical investments. If the manufacturing industry had been included, the fall in capital value would have been still greater; but in the course of ten years many new factors have arisen in British electrical manufacturing, and these would have to be taken into account in making a fair study of the matter.

Technical Guarantees.

An article appeared in our esteemed contemporary the *Engineer* on September 24th, dealing with "Technical Guarantees in Engineering Contracts," which should be read with interest by engineers and others concerned with contract work. Competition has increased so greatly of late years that it is a difficult matter to decide on the best offer when considering a number of tenders. In some quarters price is the only consideration, but most engineers recognise that, despite the tendency towards standardisation, there are many variations in the design and construction of machinery which influence the results obtained in practice.

Too much reliance must not be placed on guarantees given by contractors before acceptance, especially those of an exceptional nature. High-class firms are naturally loath to give guarantees of steam consumption or efficiency which cannot be obtained in practice, though the insertion of truthful figures in a form of tender may lead to the loss of a contract, for it is well known there are firms which are willing, in order to obtain work, to give guarantees for efficiency or delivery that they know cannot be realised, and also to accept almost any price or conditions of contract.

Municipal engineers are frequently called upon to give expert advice on technical matters, and should possess the strength of character to recommend their committees to reject tenders quoting low prices or unduly favourable guarantees. Penalties and powers of rejection are difficult to enforce and unsatisfactory to all concerned, and if they know that the firm giving the most favourable offer has failed elsewhere to meet its obligations regarding operation and reliability, they should not allow their committees to recommend the acceptance of such tenders without protest.

Complaints are heard at times that some foreign concerns have not been too particular in the undertakings that they give, though some purely British concerns have not been free from blame in this respect. It is not an edifying spectacle when competition for an important undertaking resolves itself into an auction of exaggeration; it may be difficult to reject a tempting offer, but it should be done, for if a contract is accepted under guarantees which are not fulfilled, any subsequent enforcement of penalties may be regarded as an acknowledgment of weakness or incompetence on the part of the engineer which he is naturally reluctant to make.

The responsibility for the present state of affairs rests more with engineers and the fashionable system of control by lay committees than with contractors. As long as people ask for what they know they cannot get, and expect marvellous results and the best workmanship at lowest prices, contractors will be found willing to make the necessary promises, hoping to wriggle out of their undertakings at a later date.

Heat Transmission.

Every subject connected with engineering has been treated pretty completely in detail by the many workers in each particular branch; but no one man has known the whole subject. Each writer has elaborated a small portion at a time. The result is that to acquire a full knowledge of the work done upon any branch, it is necessary to search through innumerable publications. Some men present their work to the public in the form of a paper read before some Institution; others, perhaps, unconscious of the full value of something they have done or thought out, bury their work in an obscure chapter of a book, and others publish more or less casually in the technical Press. On this account, in order to facilitate the study of heat transmission in boilers, Prof. W. E. Dalby, in a paper presented to the Institution of Mechanical Engineers on October 15th, has placed before the members an index of the literature dealing with this subject. This index covers about 35 pages, and gives the date of publication, the title of the paper or book in which the article was published, the author's name, and the library where the publication may be found. The working up of this index, and the study of each paper to the extent necessary to give the abstract that is to be found in the Institution library, must have involved great labour.

The author indicates in his opening remarks the general nature of the problem of heat transmission across a boundary. Heat radiation into space from a black body is proportional to the fourth power of the absolute temperature. This explains why the first heating surface in a boiler is so very much more efficient than the later heating surface.

Prof. Dalby also gives a diagram of the several curves that have been drawn by different men, from Newton to Petavel, as published by Prof. Callendar in *Nature*. All the curves pass through two common points, at zero temperature, and at 1,800° F. (abs.) and 7,000 B.TH.U. radiation per sq. ft. per second.

All this has been repeatedly demonstrated practically by various experimenters, who have divided the water space of boilers into sections, and found the heat given to each section. The facts emphasise the absurdity of too much striving after heating surface and of too liberal air supply to a furnace, while they uphold the contention for high-temperature furnaces, so necessary for smoke prevention.

The transmission of heat by conduction and convection takes place first through a cold film of gas clinging to the plates, and then through the surface of contact of gas and plate. Next there is the path through the solid plate, and then a breaking-out resistance into the clinging water film on the water side of the plate, after which there comes the general mass of water. In addition, there is the resistance of soot on one side and scale and oil on the other side to be considered. The metal plate resistance is hardly worth counting as such, for a 1-in. copper plate only offers a resistance of 1, as compared with 2 for the water film $\frac{1}{200}$ in. thick, and 97 for the gas film, also $\frac{1}{100}$ in. thick. Thus the material of the plate and its thickness hardly count if in metallic continuity.

Hirsch showed that vegetable grease was more dangerous than mineral oil upon furnace plates, and generally the most dangerous greases were those that were more easily decomposed.

Breckenridge found nearly 10 per cent. loss of efficiency with a scale of $\frac{1}{32}$ in. to $\frac{3}{64}$ in., and deduced the loss as varying as the square root of the thickness. The structure of the scale has greater influence than the thickness.

It ought to be an excellent thing to destroy the gas and water films which cling to the plates. Hence the value of high velocity of gases and of whirling movements or brush effects. The serious effect of films probably explains to some extent the heat peg theory, for it must be difficult for films to adhere to projecting heat pegs swept by the flames which fail actually to touch the plates.

The author notes finally how Cornish boilers still remain substantially as they have been for a hundred years. Nor have water-tube boilers shown much better results. Much, of course, depends on the mechanical needs of a vessel to carry pressure. Safety has to be the predominant factor, and this is what fixes types, and puts early limits on many proposed departures from the existing state of things. We must certainly express gratitude for the exceedingly valuable index thus presented to engineers.

MODERN ELECTRICAL MACHINERY: ITS DESIGN, COST AND EFFICIENCY.

By L. CROUCH.

The present article can be little more than a series of remarks concerning a number of curves collected by the author and placed in a form which it is believed will prove generally convenient. These curves (figs. 1-9A) deal with the weight, speed, cost, efficiency and power factor of direct and alternating-current generators and motors, and may be taken as typical of modern design in these matters. Much has been written from time to time concerning the determination of such figures during the design stages of machine construction, but little has been published, in a manageable form, to enable the general user or the mechanical engineer to determine the general properties of the motor required to operate his tool or crane, &c. In the past, very clumsy work has frequently been turned out by good works, owing to the lack of co-operation between the mechanical and electrical departments. For instance, the engineers designing a crane were insufficiently informed of the size, weight and speed of the motor that would probably be used to operate it: the result was, in many cases, that a motor, unsuitable electrically, had to be fitted to conform to the mechanical conditions already fixed upon. Though such grave errors would not be likely to occur to-day in any but the most imperfectly-controlled works, it is still very difficult for a user, having a small grinding mill or machine tool or pump, &c., to drive, to obtain any idea of the size, weight and cost of the machine necessary for the purpose. True, he can apply to a standard maker of electric motors, and his needs will usually be carefully examined and advised upon, but it is undeniably convenient to have such information ready to hand and covering all likely ranges of conditions, even if only in an approximately accurate form. Many tentative ideas only need reference to such curves as are presented below to decide their impracticability or feasibility, as the case may be, and small users, in particular, are frequently very reluctant, rightly or wrongly, to seek advice from manufacturers. Their apparent dread of committing them elves by making such a request probably hinders the installation of electrical machinery, on a small scale, very considerably.

Let the average user become aware that a 20-H.P. motor, suitable for driving his pump, say, would weigh 700—1,000 lb., cost £60 to £70, run at any desired speed between limits of about 400 and 1,000 R.P.M., and have an efficiency of 87 to 90 per cent., and he would at once realise its advantage over a steam engine, and would be possessed of sufficiently concrete ideas on the subject to induce him to follow up the matter. Thus, even from the point of view of an advertisement of the merits of the electric motor, the accompanying curves will be found useful by canvassers and others. However, the writer finds them useful in a higher degree than the above. In the preliminary designing of an electrical installation, whether of generators or motors, with direct or alternating current, the curves here given will be found to present the desired information in a handier form than is possible by any scheme of tabulation.

Little can be *written* on the present subject if the object in view is to be attained; the whole aim is to concentrate as much information as possible *graphically*: hence, the remainder of this article is confined to remarks on the general conclusions to be drawn from figs. 1 to 9A, which are fully keyed to enable their use without continual reference to the letterpress. In the earlier curves, several types of motors and generators are discriminated between, but in the later figures mean curves have been drawn giving as representative results as possible, the only discrimination then drawn being between direct and alternating-current machines and between the full load, three-quarter load and half-load efficiencies and power factors.

The various classes into which machines are divided for the present purpose (in figs. 1-7) are, first, direct and alternating-current machines, motors and generators, and, further, ball-bearing machines, machines with ordinary bearings, and in the case of alternating-current motors, machines with "wound" and "squirrel-cage" rotors respectively. The basis to which all quantities are here referred is that of horse-power, a KW. scale being added for convenience to those sheets dealing with generators.

Fig. 1.—The curves in this diagram need little comment, being very consistent, and exhibiting no striking peculiarity.

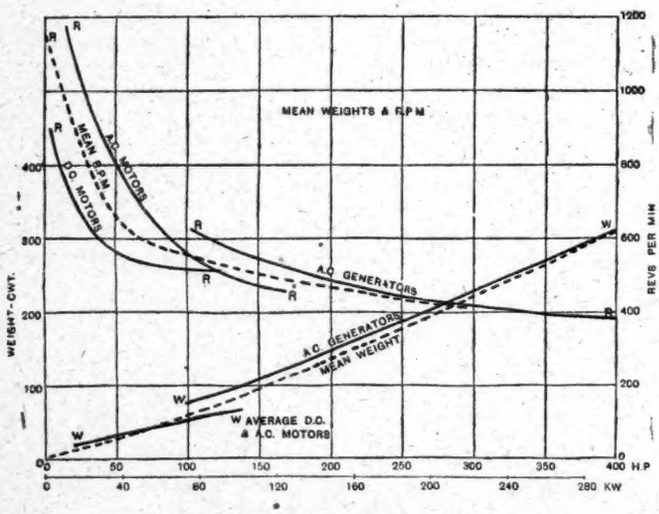


Fig. 1.—Weight, Speed and Output.

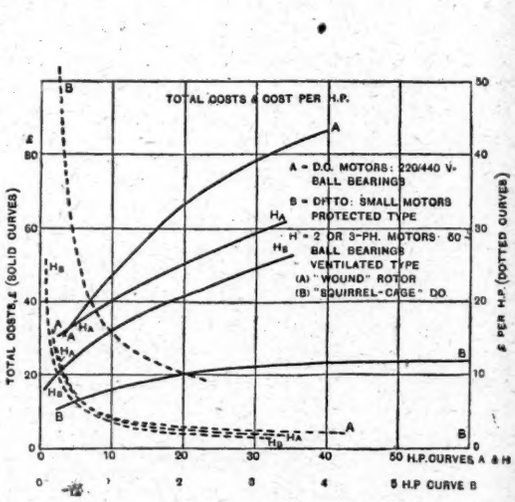

TOTAL COSTS & COST PER H.P.
A = D.C. MOTORS: 220/440 V. BALL BEARINGS
B = DITTO: SMALL MOTORS PROTECTED TYPE
H = 2 OR 3-PH. MOTORS: 50 BALL BEARINGS VENTILATED TYPE
(A) "WOUND" ROTOR
(B) "SQUIRREL-CAGE" DO.
TOTAL COSTS £ (SOLID CURVES)
£ PER H.P. (DOTTED CURVES)
50 H.P. CURVES A & H
5 H.P CURVE B

Fig. 2.—Cost and Output.

Some difficulty is, of course, experienced in deducing a mean curve between R.P.M. and horse-power for electrical machinery, since, by the use of different rotor speeds, a given carcase can be rated at widely different horse-powers, while, conversely, for a given horse-power, a wide range of speeds (usually from 2 to 4 : 1) can be secured by the use of different carcases. The curves shown, however, represent the R.P.M. at which it is preferable to run the motor if possible. In the case of alternating-current machines, the exact speed is, of course, determined by the number of poles and the periodicity of supply. It is noticeable that in the smaller units, A.C. machines usually run considerably faster than direct-current machines of the same horse-power. Above 100 H.P. output, the speed of electrical machinery becomes considerably more standard.

The weight of motors and generators naturally reflects the variability of the R.P.M. for a given horse-power. By using a small carcase and a high R.P.M. to obtain a given output a much lighter design results than if a large low-speed machine be preferred. The dotted curve (fig. 1) is representative of average practice. The slightly concave nature of the curve shows that the weight increases rather more rapidly than if it were strictly proportional to the horse-power. This effect is mainly due to the increased material necessary in the largest machines to provide mere mechanical rigidity.

Fig. 2.—The main points to be noted with regard to the curves in fig. 2 are:—(1) The rapid decrease in cost per horse-power as the total horse-power of the motor increases; and (2) the cheapness of alternating-current motors, particularly of the short-circuited rotor type.

A small motor of, say, ¼ H.P., may cost about £50 per horse-power, whereas a machine of 10—40 H.P. will require an expenditure of only £4 to £2 per horse-power. The shape of the curves shows the extreme inadvisability of installing

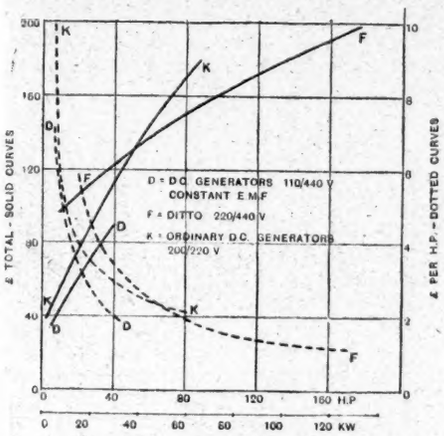

£ TOTAL - SOLID CURVES
£ PER H.P. - DOTTED CURVES
D = D.C. GENERATORS 110/440 V CONSTANT E.M.F
F = DITTO 220/440 V
K = ORDINARY D.C. GENERATORS 200/220 V
0 40 80 120 160 H.P
0 20 40 60 80 100 120 KW

Fig. 3.—Cost and Output.

machines of less than 10 H.P., provided units of the latter or greater output can be fully employed. Above outputs of 10 to 20 H.P., the cost per horse-power decreases much more slowly. The cost of slip rings and brushes, &c., is approximately constant for all sizes of motor between 5 and 30 H.P., so that the cost curves for machines with "wound" and "squirrel-cage" rotors are almost parallel to each other throughout. The costs on this sheet of curves refer to ball-bearing motors, but the costs are little different if ordinary bearings be specified; indeed, if the smaller units of a "line" of machines built up to high horse-powers be used, their cost may well be greater than that of the machines dealt with in fig. 2. The reason for this is that ball-bearings are seldom used on motors of over 40 H.P. output, so that all machines so fitted are essentially small-capacity designs, and hence lighter and cheaper than the smallest machines of ordinary motor classes in which are preserved some of the heavy features of design essential in the larger units, but unnecessarily increasing the cost of the smaller machines.

Fig. 3.—The curves of fig. 3 form a closely concordant set necessitating little remark. The high cost per horse-power of some of the smaller units is again to be noted. The price per horse-power of the medium-sized machines (say, 40 H.P.) is about the same as that of the corresponding machines in fig. 2, but the larger units (160 H.P.) fall still further in specific cost, finally reaching £1·20 per horse-power, and excellently illustrating the economy of installing as large units as possible.

Fig. 4 treats of alternating-current generators of outputs ranging from 2 to 300 KW.; four types of machine are dealt with, viz., single-phase machines, two or three-phase machines, belt-driven and direct-coupled in each case. The key to the reference letters is inset in fig. 4. The ascending order of total cost of the types dealt with is:—Direct-coupled two or three-phase machines (cheapest), belt-driven two or three-phase machines (5 per cent. to 10 per cent. dearer), one-phase direct-coupled machines, one-phase belt-driven (again about 5 per cent. to 10 per cent. dearer than the direct-coupled machines). Only the mean cost per horse-power for the four types has been plotted, for the sake of clearness. It will be seen that the specific costs are here considerably greater than in figs. 2 and 3, though the type of curve is unaltered. On this point more is said below. The ascending order of weights of the four types is the same as that of the costs, so that the cost per cwt. is about the same throughout. These alternators are of considerably heavier build than the machines dealt with in figs. 2 and 3, and to this fact much of their increased cost is due.

With regard to the speed of the machines—the belt-driven units run from 15 per cent. to 25 per cent. faster than the direct-coupled machines, the greatest *percentage* difference of speed being naturally on the slower (*i.e.*, the larger) units. The higher speed of the belt-driven machines tends to decrease their cost per KW., but the necessity for a pulley and, usually, a third bearing, together with the longer bed-plate and heavier foundations entailed, generally overbalance this tendency.

Fig. 5.—In fig. 5 are collected the chief results of figs. 2, 3 and 4, together with other information, the whole covering a range of horse-power from 10 H.P. to 400 H.P. (*i.e.*, up to 300 KW.). From these curves it appears that direct-current motors are cheaper than alternating-current machines, except in small units. This statement must not be accepted as final, since much depends on the maker, on the exact requirements of the purchaser (speed, frequency, &c.) and on the accessory equipment necessary. The dotted curves (fig. 5) may be accepted as sufficiently accurate for any normal alternating or direct-current machines within the range of horse-power dealt with. The case of the alternating-current generators is rather a special one. The machines here appear unduly expensive, but in larger units their cost per horse-power is much reduced. The class of alternator represented by this curve is heavier than is always necessary and, in a later article, the writer hopes to go more fully into the question of the cost of alternators. This cost is very dependent on the specification to which the machine is built (voltage regulation, power factor, &c.), and is, in most cases below 500 H.P. output, considerably greater than that of the corresponding D.C. generator.

In figs. 6, 7, 8 and 9 are treated the most important constants of electrical machines from the operative point of view—viz., the efficiency and power factor obtainable under various conditions of loading. The importance of high efficiency and power factor is frequently imperfectly realised: in general, the higher the efficiency and power factor of a motor or generator the higher its capital cost, and since the running cost of the whole equipment is less the higher the efficiency, and the cost of much of the accessory apparatus (in the case of A.C. machines) is less the higher the power factor, it is clear that any increase in the efficiency and power factor of an electrical machine has a definite capital value.

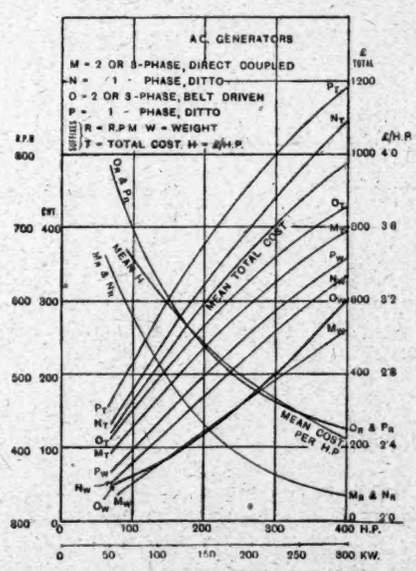

A.C. GENERATORS
M = 2 OR 3-PHASE, DIRECT COUPLED
N = 1 - PHASE, DITTO
O = 2 OR 3-PHASE, BELT DRIVEN
P = 1 - PHASE, DITTO
R = R.P.M. W = WEIGHT
T = TOTAL COST. H = £/H.P.
£ TOTAL
£/H.P
MEAN TOTAL COST
MEAN COST PER H.P
0 100 200 300 400 H.P.
0 50 100 150 200 250 300 KW.

Fig. 4.—Speed, Weight, Cost and Output.

The extra amount which it will pay the purchaser to expend per added 1 per cent. of efficiency or rise of power factor, is such that the interest on this capital outlay equals or is less than the net working economy attributable to the improved efficiency or power factor (after allowing for the capital cost of all accessory equipment and for any increase in certain items of the running cost necessary to secure the higher efficiency or power factor). The bonus which may be offered for every 1 per cent. higher efficiency and power factor above the value specified in the tender may thus be readily determined in every case. The purchase of a low efficiency motor, because it is capitally cheap, is not necessarily a good invest-

ment in the long run. The problem is entirely a commercial one, and may be solved as such.

The lettering attached to the curves of fig. 6 and the succeeding figures is to be thus interpreted :—The capital letters refer to the keys inset in the various figures, the numeral $\frac{1}{2}$, $\frac{3}{4}$ or 1 refers to a $\frac{1}{2}$, $\frac{3}{4}$ or full-load test respectively ; η means that the curve deals with the efficiency of a machine, while $p\,f$ denotes that the power factor is the function dealt with.

Fig. 6, dealing with direct-current and alternating-current ball-bearing motors, shows that over the range of horse-power treated there is little to choose between direct and alternating-current machines, the alternating-current machines having the advantage, particularly at half-load. The latter is not necessarily always the case : by varying the design and somewhat raising the cost per horse-power, a very high efficiency can be secured on a direct or alternating-current machine at practically any desired load. The very considerable drop in efficiency as the output of the motor falls below 10 H.P. is to be noted, and forms a further disadvantage consequent on the use of small machines. It is to be noted that the power factor falls considerably faster than the efficiency as the load falls from its normal value. Thus the efficiency of a 30-H.P. alternating-current motor (fig. 6) falls from 89 per cent. on full load, to 87·5 per cent. on half-load, whereas the power factor falls from 89 per cent. to 83 per cent. over the same load range. The fall in efficiency from full to three-quarter load is usually only one-half to two-thirds that occurring between three-quarters and one-half full load, and such a distribution is very desirable, since a motor properly chosen for its load will usually run at between three-quarter full and its full rated output.

Fig. 7.—The curves of fig. 7 clearly show the generally acknowledged superiority of direct-current motors in the matter of efficiency of larger units. The direct-current machines have an advantage of from 2 per cent. to 3 per cent. at full load and slightly more at half-load. The very considerable fall in power factor of alternating-current motors from full to half-load is again shown, and is here more serious than in fig. 6, chiefly owing to the greater slip, which is, for instance, now 4 per cent. at about 50 H.P., whereas in fig. 6 it is then only about $2\frac{1}{2}$ per cent. Apart from these points there is little to note in fig. 7 beyond those already noted for fig. 6. The efficiencies are, in general, the same in both cases. The ball-bearing machines have naturally a slight advantage in this respect.

Fig. 8 deals with the efficiency of generators, the curves shown being based on three types of machine covering a range of outputs from 3 H.P. to 180 H.P. (2 KW. to 140 KW.). The curves lie close together and enable average efficiency curves to be deduced, as in fig. 9. The efficiencies agree closely with those given for D.C. motors in figs. 6 and 7, and this would be expected, since there is no inherent difference between a direct-current motor and generator. The remarks regarding the $\frac{3}{4}$-load efficiency being greater than the mean of the full and half-load efficiencies again apply. The efficiency of 93 per cent. obtainable in 170-H.P. generators at full load is not exceptional : an even higher efficiency can be secured, and on smaller machines, by the exertion of special care in the design of the machine. At the present day the efficiency of some units in the series of

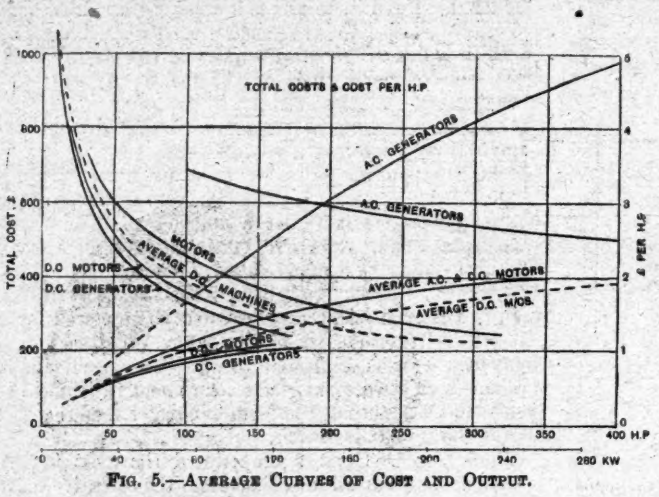


Fig. 5.—Average Curves of Cost and Output.

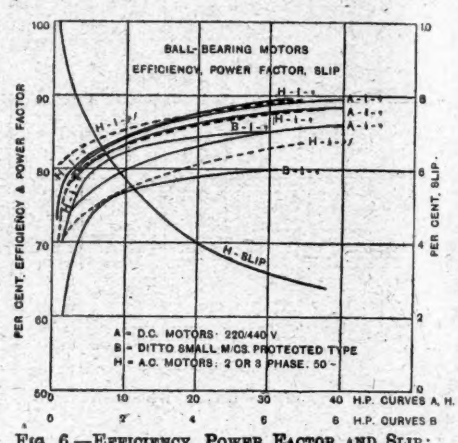

BALL-BEARING MOTORS
EFFICIENCY, POWER FACTOR, SLIP
H-SLIP
A = D.C. MOTORS 220/440 V
B = DITTO SMALL M/CS. PROTECTED TYPE
H = A.C. MOTORS, 2 OR 3 PHASE, 50 ~
PER CENT. EFFICIENCY & POWER FACTOR
PER CENT. SLIP
H.P. CURVES A, H.
H.P. CURVES B

Fig. 6.—Efficiency, Power Factor and Slip; Ball-bearing Motors.

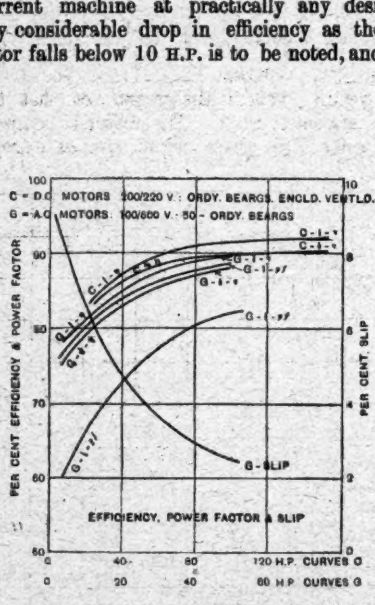

C = D.C. MOTORS 200/220 V. : ORDY. BEARGS. ENCLD. VENTLD.
G = A.C. MOTORS 100/600 V. 50 ~ ORDY. BEARGS
G-SLIP
EFFICIENCY, POWER FACTOR & SLIP
PER CENT EFFICIENCY & POWER FACTOR
PER CENT. SLIP
120 H.P. CURVES C
60 H.P. CURVES G

Fig. 7.—Efficiency, Power Factor and Slip; Motors with Ordinary Bearings.

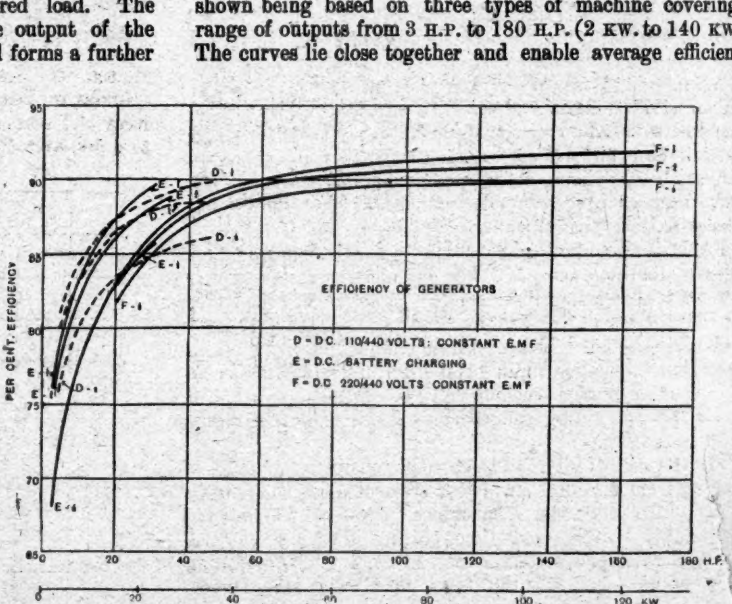
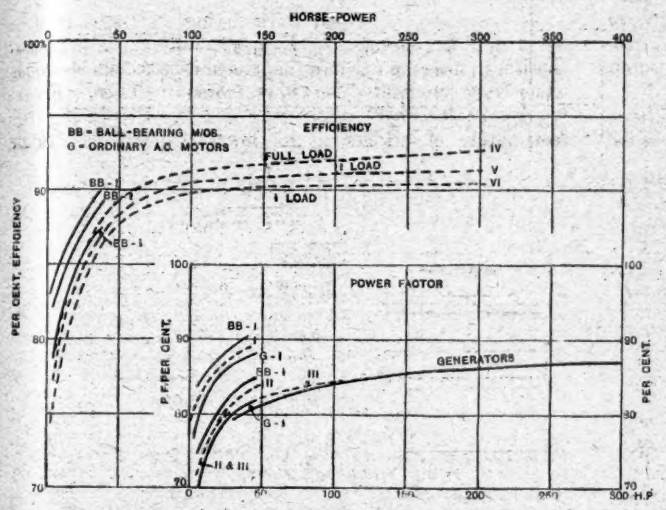

EFFICIENCY OF GENERATORS
D = D.C. 110/440 VOLTS : CONSTANT E.M.F
E = D.C. BATTERY CHARGING
F = D.C. 220/440 VOLTS CONSTANT E.M.F
PER CENT. EFFICIENCY
120 KW

Fig. 8.—Efficiency of Generators.

a given type of machine is frequently slightly sacrificed to obtain a convenient standardisation of machines, whereby a minimum number of parts and patterns will cover a maximum range of motors or generators as regards output and speed.

Figs. 9 and 9A.—The curves on this page form a convenient summary of the results expressed in full by figs. 6, 7 and 8. Ball-bearing machines are discriminated from those fitted with ordinary bearings, since the increased efficiency consequent on the use of the special bearings amply compensates their adoption, on small motors particularly. The power factors of alternating-current machines are summarised in the inset diagram, fig. 9A. The dotted curves I, II, fig. 9A, show the mean power factors to be expected



FIGS. 9 AND 9A (INSET).—SUMMARY OF RESULTS GIVEN IN FIGS. 6, 7 AND 8.

from normal alternating-current motors on full and half-load respectively, while curve III deals with alternating-current generators of the type already referred to (figs. 4 and 5). The efficiency curves IV, V and VI, fig. 9, show reasonable values to be assumed for the efficiency of electrical machinery in general (excepting those machines fitted with ball bearings, which are separately dealt with) on full, ¾ and ½-load respectively.

No further comment is necessary on this family of curves, except to reiterate that electrical machinery, having an efficiency varying from 80 per cent. to 95 per cent. on full load (less by only about 1 per cent. to 2 per cent. on three-quarter load and 3 per cent. on half-load) has assumed a position in modern engineering and manufacturing practice, the importance of which it is difficult to over-estimate, and which it would be impossible to fill by any other means.

It is the author's sincere hope that the present set of curves may lead to a yet more general appreciation of the merits and possibilities of electrical machinery, and be as useful to others in roughing out designs of every description as they have proved to himself.

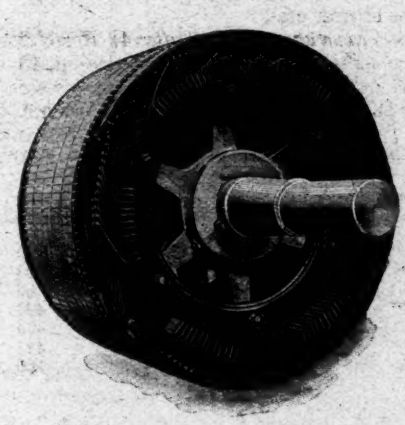
The L.C.C. Stores Appointment.—It will be remembered that the L.C.C. advertised a short time ago for a Chief Officer of Stores at £1,000 a year. It was reported to the Council on Tuesday that there were 300 applicants for the position. Of these 36 were selected for interview, and 35 responded. The Stores Committee then reported that in their opinion none of them were so fitted for the appointment as Mr. F. W. Mackinney, one of the assistant clerks of the Council, who for nearly three years has been entrusted by the clerk of the Council, with the work of store reorganisation which has been carried on under the directions of the Stores Committee, who accordingly recommended his appointment. The Stores Committee submitted, with the name of Mr. Mackinney, the names of five of the candidates. Each of these has been seen by another Committee, which endorsed the opinion of the Stores Committee that Mr. Mackinney should be appointed to the position. To comply with Standing Order No. 86, three names were submitted, as follows:—Mr. E. J. Allen, Mr. G. H. K. Kingdon, Mr. F. W. Mackinney.

The matter came before the Council on Tuesday, and the recommendation was adopted by 37 votes to 13, after discussion, in the course of which objection was made to the way in which the appointment had been carried through.

A NEW TYPE OF CASCADE INDUCTION MOTOR.

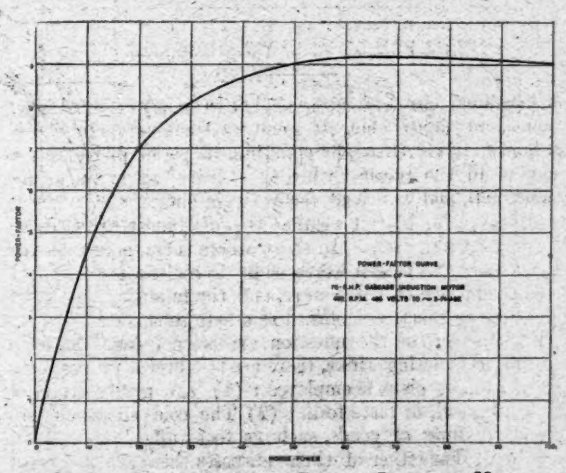
By M. I. WILLIAMS-ELLIS, M.Inst.M.E.E.

THE cascade induction motor is no new idea, although there are few examples that have given a really good account of themselves, being generally an inefficient and cumbersome form of apparatus. But a motor of this type has now found its way into both the English and foreign markets, which is a most practical and highly efficient machine, being manufactured by the Sandycroft Foundry Co., under the patent rights of Mr. L. C. Hunt, M.I.E.E.



ROTOR OF CASCADE MOTOR.

Being the first in this country to adapt the above type of machine for haulage use, I have no hesitation in putting forward the figures obtained as the result of a test taken by me of a 70-B.H.P. cascade motor haulage set that I have erected for Messrs. The Buxton Lime Firms Co. at their quarries in Derbyshire; this is the second set that they have had erected for such work. The motor is connected to a 500-volt 50-cycle three-phase circuit, and as a drop in



CURVE OF POWER FACTOR OF CASCADE INDUCTION MOTOR.

the line had to be allowed for, the machine was designed for a pressure of 485 volts. Both sets have given full satisfaction, and have proved themselves well suited to the work, the chief advantages being total elimination of slip rings, with the full characteristics of a slip-ring motor. The windings on both stator and rotor are of a simple nature, and the machine is controlled through 12 tappings taken from the parallel windings of the stator and worked in pairs, each pair being finally short-circuited when the machine has reached approximately its final speed. Both machines are of the 12-pole

type, while the air-gap is kept very short, and for this reason, to provide against a bearing wearing the slightest shade, a simple device for recentring has been added.

The above motors are each connected through double-reduction gearing to a set of four drums giving a rope speed of 4½ miles per hour, which is a maximum safe working speed upon roads as laid in this class of quarry work. The motors themselves have raw-hide pinions fitted, and in spite of the humidity of the locality I have found such pinions work without the slightest sign of wear or detrimental effect due to climate, in conjunction with haulage motors erected some four years back.

The efficiency of a Cascade motor is naturally expected to be low, and for this reason the full-load efficiency of 85 per cent. was specified, while the actual tests gave the following: Full-load efficiency, 88·5 per cent.; half-load efficiency, 87 per cent.; 1½ load efficiency, 89 per cent. The specified overload was 100 per cent.: the actual overload developed on test was 110 per cent.

Final Temperature Reached after 4½ Hours' Run.—Stator winding, 62° rise; surface of stator winding, 48° rise; stator core, 67° rise; rotor copper, 46° rise; rotor core, 55°.

The following are test figures of a 70-B.H.P. three-phase "Cascade" motor, 50 cycles, 492 R P.M., 485 volts, taken by the writer for the Buxton Lime Firms, in 1909.

Wattmeter readings.	Per phase. Volts.	Amperes.	8-pole alternator. R.P.M.	Motor. R P.M.	Power factor.
59,900	490	76·8	770	—	·918
57,270	485	73·5	760	490	·919
61,500	483	80	760	490	·92
57,690	485	75·2	750	485	·91
58,050	479	76·2	760	490	·92
57,690	483	75·4	750	480	·91
63,420	489	81·5	760	485	·92
58,200	492	74·5	770	500	·91

No-load Readings.

4,030	488	18·65	760	500
4,020	488	18·65	760	500

Insulation Test.

2,000 volts A C. for three minutes from all windings to earth.

SOME NOTES ON REFRIGERATING MACHINERY.

By FRANCIS H. DAVIES, A.M.I.E.E.

As a desirable class of load for electricity supply undertakings, there is no doubt that refrigerating machinery occupies a prominent place. Generally speaking, its period of maximum work is in the summer when the station output is at its lowest ebb, and the load factor is in almost all instances good, as in the hottest weather the machinery has often to be run 24 hours daily. In short, where there is any chance of succeeding, it is well worth while to make a special effort to cultivate load of this nature, and the following outline of refrigerating practice is offered as a help to this end.

Leaving out of the question exceptional cases, such as natural ice skating rinks, there are two broad purposes for which freezing plant is employed: (1) The manufacture of ice in can, cell, or plate form; (2) The cold storage, freezing or chilling of goods, such as foodstuffs, furs, tobacco, beer, &c. For either of these purposes there are at present two leading types of machines on the market, one of which operates on the ammonia compression system, and the other on the carbon dioxide principle. It is not necessary to go into the relative merits of the two, upon which point there is, of course, some divergence of opinion. Both are successfully employed, and to the supplier of electricity it matters little which system is adopted. Fig. 1 is a diagram showing the action of a plant employing anhydrous ammonia (NH_3), a liquefied gas. Following its course from and back to the compressor, the ammonia gas under high pressure is delivered to the condenser, being there cooled by the action of the circulating water and converted into a liquid. It is now allowed to expand into the refrigerator coils, where it turns again into a gas, producing an intense degree of coldness. After passing through the coils the gas flows back to the compressor, and the operation starts over again.

The refrigerator may take several forms, according to the purpose for which it is to be employed, and the degree of efficiency required from it. For cooling a store, the most usual course is to place the refrigerator coils in a part of the room partitioned off from the rest, circulating the cold air through the room or rooms by means of a fan, and if more than one room is used, through wooden ducts fitted with dampers.

There are, however, elaborations of this system involving the use of brine circulating pipes, &c., which, though interesting, are rather beyond the scope of a cursory review. Particulars may be obtained from numerous makers, and they should certainly be investigated before any serious work is undertaken.

As previously indicated, refrigerating apparatus is used either for cold storage, freezing, or chilling. The former consists in maintaining in a sound condition perishable goods which have previously been either frozen or chilled. Freezing speaks for itself, and chilling consists of reducing the temperature of articles to not lower than 35° F. Some

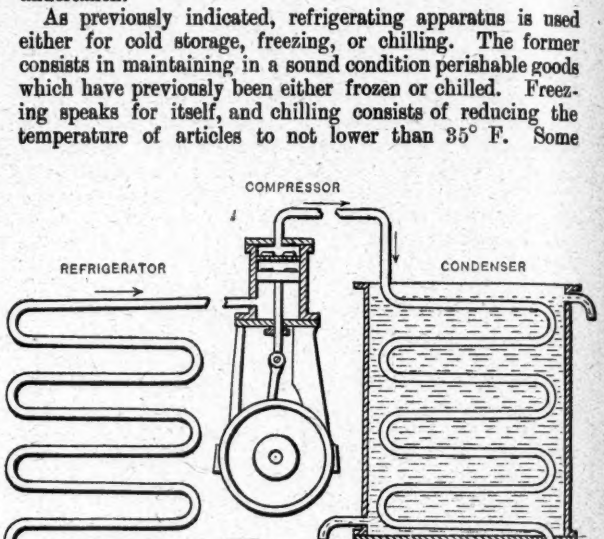


Fig. 1.—Diagram of the Ammonia Refrigerating System.

makers recommend 34° F. as the best all-round temperature for cold storage, but it should be noted that various goods require different temperatures, and to secure the best results this point should be carefully looked into.

To give a few examples taken from common practice. Eggs require a temperature of 34°, fresh meat 35°, cheese 32°-33°, fresh fish 25°-30°, game 25°-28°, furs 35°, and frozen rabbits as low as 15°.

A most important point in cold storage or freezing installations is the method of insulating the refrigerating chamber. All six sides must be thoroughly lagged, and the usual practice in well-planned installations is to allow, in the following order, 1 in. air space from the wall, one layer of 1 in. tongued and grooved boards, two layers of waterproof paper, 6 in. of slag wool or silicate cotton, two layers of waterproof paper, and one layer of 1 in. tongued and grooved boards. If considered desirable, the inner layer of boards and the air space may be dispensed with, but in this case the wall should be given a good coating of waterproof paint.

So much of the efficiency of an installation depends upon the lagging of the chamber, that too much attention cannot be accorded it. Unfortunately, the average butcher or provision dealer's cold storage room is generally not at all well lagged, and this constitutes one of the greatest difficulties in persuading him to substitute a freezing plant for the usual archaic method of filling the store with blocks of ice. Without proper insulation the best results cannot be promised, and while a man may be willing to go to the expense of installing the machinery, he generally objects to having to rebuild or alter the walls of his store.

Since even a small butcher with his primitive ice-box will often expend 20s. to 40s. a week on ice during the hot weather, it is possible even under bad conditions to show him a monetary saving; but bad lagging will necessitate longer hours of running, and that is the rock upon which many negotiations have split. To reduce the hours of running, a very efficient accumulator system which gives a good reserve of cooling power has been introduced by the Pulsometer Engineering Co., and other firms. It will meet

cases where Sunday or all-night running is out of the question, but it, of course, involves additional capital expenditure.

As conditions vary so considerably, it is impossible to give hard and fast figures to apply to any case; the power required, and therefore the cost, may, however, be estimated from the following figures given by Messrs. Ernest West and Benyon, Ltd. :—

Internal capacity of insulated cold rooms at 34° F. cb. ft.	B.H.P. required by compressor.
350	2
700	2½
1,100	3¼
1,600	3½
2,800	4
4,000	5
7,000	6½
9,000	8

In conclusion, it many be of assistance to append some arguments which may fairly be employed in support of refrigerating plant *versus* the ice box. First, there is the question of monetary saving, which is particularly noticeable in the case of large plants. Owing to loss by melting during carriage, the cost of ice in outlying districts is often very high, and in such cases it is a simple matter to show and guarantee a saving that should prove a powerful inducement. In effectiveness there is also much to say in favour of a machine, and a great deal against the ice box. Temperature cannot be properly controlled by the latter; the air in the room is damp; the ice, if natural, may come from very unhygienic sources, and the ice and its bin take up a deal of room in the very place where it cannot be spared.

Upon all these points the refrigerating machine obviously shows up to advantage; there is better circulation and dry air, and—an important point—the temperature is easily regulated. The question of capital outlay is often one of some difficulty, and can only be met by some form of hire-purchase scheme. Roughly speaking, the price of a small installation to deal with a storage room of 700-800 cb. ft. capacity is £90, the room itself, the motor and accessories being extra. The majority of firms will be found quite willing in hopeful cases to supply plants on trial, and by this means, coupled with the unquestionable advantages offered, it is quite possible to do much good work among butchers and provision dealers.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Magnetising Current of an Induction Motor.

The magnetic fluxes in an induction motor can be divided up as follows :—

1. The working flux.
2. The stator leakage flux.
3. The rotor leakage flux.

The stator current will produce a magnetic flux in the stator, and the induced current in the rotor will produce another flux perpendicular to the stator flux; the resultant of these will be the working flux, and the current taken by the stator to produce this flux will be the magnetising current (that is, the resultant of the stator and rotor currents).

The stator leakage is that part of the flux which does not enter the rotor, but passes from tooth to tooth; therefore it does not affect the rotor conductors, but it appears in the form of self-induction in the stator windings.

The rotor leakage is that part of the flux which is formed in the rotor core, and does not enter the stator; this produces a back E.M.F. in the rotor windings, and will tend to demagnetise the stator, so causing an increased stator current to overcome this. The stator and rotor leakage increase with the load. If a motor is running unloaded the magnetising current taken will be sufficient to maintain the resultant flux due to the stator and rotor currents.

In the case mentioned by "Troubled" there will be no rotor flux or leakage due to rotor current, therefore the current taken by the motor will only be that necessary to produce the stator flux and leakage. The magnetising current taken by a single-phase motor will be much greater than that taken by a polyphase motor per phase, as there is a large current in the rotor which is almost wattless; this current is sufficient to produce a flux at right angles to the stator flux, and this causes an increased stator current.

If the motor in question is a single-phase one, the fact of its being open-circuited will decrease the stator current considerably.

W. Dancer.

Manchester Exhibition Accounts.

In answer to the numerous inquiries from exhibitors and others as to the delay in publishing the above, I would say that this has been occasioned entirely by the special conditions under which the Exhibition was organised, but I hope that the trade will be satisfied with the results that have now been put before them.

C. S. Northcote,
Late General Manager to the Exhibition.

London, S.W., *October 14th*, 1909.

Coefficient of Self-Induction.

In quoting a few lines from our previous letters your reviewer, we think, hardly does us justice. Our statements, of course, should not be construed apart from their context; and your readers, recognising this, will see that the meaning suggested by your reviewer cannot fairly be read into our letters. For this reason we are well content to leave the matter in their hands.

With the statement in italics at the end of your reviewer's last letter we find ourselves unable to agree. In a strict academic sense it is, of course, true; but we think that to abandon Maxwell's coefficient merely because it is not constant throughout a half wave, would be to take a course which, if logically followed, would effectively destroy every ordinary alternating-current calculation. By substituting for irregular waves their equivalent sine waves, the coefficient, as defined by Maxwell, may be made to serve in vector equations; provided that the density in the iron does not approach saturation. A complex number is, as we have pointed out, involved in the coefficient when so used, unless iron losses be neglected.

All this follows from, and is exemplified in, the work of Steinmetz, S. P. Thompson, and many others. In case, however, your reviewer does not admit the authority of such writers, we might perhaps refer him to an author whose dictum we have reason to think he will not question. In Dr. Russell's second volume of "Alternating Currents" he will find under the equations for a transformer an expression for Maxwell's coefficient in terms of the reluctance of an air circuit. Dr. Russell further points out that, to an iron circuit with constant permeability, these equations are applicable; and in subsequent calculations not only does he assume the permeability as constant, but he also attempts to justify the neglect of iron losses—of which neglect at least *we* are not guilty.

We think that perhaps we may congratulate ourselves on one result of this correspondence, viz., that it has apparently caused your reviewer to modify his opinion as to the relative usefulness of the two forms of the coefficient of self-induction.

On August 6th he writes, in comparing the use of Maxwell's coefficient with that commonly adopted by electrical engineers, "We are, therefore, at a loss to understand the greater convenience of the coefficient used by electrical engineers."

On October 15th he writes of Maxwell's coefficient that it "cannot be used in vector equations at all."

C. F. Smith,
William Cramp.

Municipal School of Technology,
Manchester, *October 18th*, 1909.

Applications for Employment.

For some time past there have been advertisements in your columns from persons who claim to be able to set out applications in such a striking way as to attract the notice of prospective employers and enhance their chances of success. For the benefit of those who are striving to obtain posts, would any of the Review readers kindly say if they have ever availed themselves of these offers, and if by following their advice they have succeeded in obtaining posts which they honestly believe they could not have secured if they had made out their own applications?

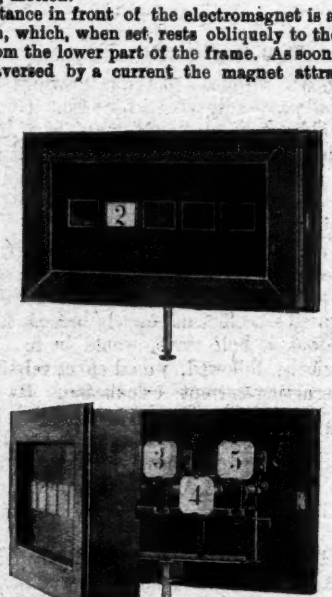
Luckless.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A Novel Indicator Board.

A vertical indicator board recently brought out by Messrs. Mix & Genest, of Schöneberg-Berlin, is provided with a drop of extreme simplicity, the vane stem being designed to work also as the armature of an electromagnet. Unlike the usual type of indicator, in which the jacks rotate or oscillate round an axis after being disengaged, the design of this "vertical" board is based on a simple falling motion.

A short distance in front of the electromagnet is an extension of the vane stem, which, when set, rests obliquely to the vertical on a projection from the lower part of the frame. As soon as the electromagnet is traversed by a current the magnet attracts this stem,



Figs. 1 and 2.—"Vertical" Indicator Board.

drawing it into a vertical position. Directly the current is interrupted the vane is disengaged, and the drop falls into position behind the window.

The drop is replaced mechanically by a slide working from beneath; the rod protruding from the box is connected inside the latter with a horizontal bar, which when lifted presses against the angular end of the vane stem, and this being raised strikes an inclined slide which sets the jack in an inclined position. Very little energy is required to actuate the indicator, and the size and weight of the board are reduced to the minimum.

The Wilkinson Thermal Column.

Mr. Geo. Wilkinson, borough electrical engineer, Harrogate, has devised a new apparatus for returning water condensed in steam pipes, &c., to the boilers without loss of heat. The "Thermal Column," as it is called, consists essentially of two chambers—the sump and the receiver—connected by a pipe, the sump being placed at a low level so that water draining from the steam range, separators, jackets, &c., will flow into it by gravitation, while the receiver is situated 5 or 6 ft. above the tops of the boilers, with which it is connected by a pipe with a non-return valve. In operation, water collects in the sump until it seals the rising pipe, thus cutting off the latter and the receiver from the supply of live steam. Directly this happens, the pressure in the receiver drops, and the water in the sump is forced up the pipe into the receiver, until steam re-enters the pipe and establishes equilibrium of pressure in the two chambers, while the water raised flows from the receiver into the boilers. To provide against excessive rushes of water into the sump which might overcharge the receiver, an automatic relief valve is fixed on the latter, but such flooding does not occur under normal conditions. The apparatus, we are informed, has been in successful operation for nearly 12 months at the Harrogate Electricity Works, where it may be seen by those interested. It will be noticed that the column has no opening to the atmosphere, so that there is no loss of heat by evaporation—the only loss being the slight radiation from the lagged surfaces of the chambers and pipes; there are no moving parts, and the operation is entirely automatic. The system is applicable to the steam heating of buildings, as well as to power stations.

A Dioptric Sign.

The Dioptric Sign Co., Ltd., of 4, York Buildings, 78, Duke Street, Liverpool, have introduced a system in which each letter is fitted with a dioptric lens and lighted with a single lamp, the effect being uniform illumination of the whole of the letter, as shown in fig. 3 herewith. It is claimed that this constitutes a great advance

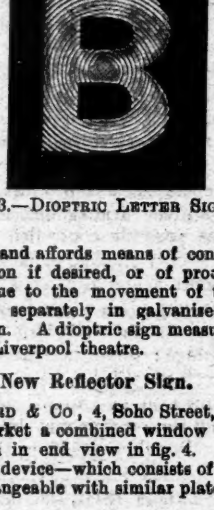


Fig. 3.—Dioptric Letter Sign.

over present practice, and affords means of concentrating the light in a particular direction if desired, or of producing an effect of automatic flashing, due to the movement of the observer. The letters are built up separately in galvanised steel cases, and measure 15 in. × 12 in. A dioptric sign measuring 22 ft. over all is being erected at a Liverpool theatre.

New Reflector Sign.

Messrs. W. Leonard & Co., 4, Soho Street, Oxford Street, W., are placing on the market a combined window lighting and advertising reflector, shown in end view in fig. 4. It will be seen that while the advertising device—which consists of a frame containing a letter plate, interchangeable with similar plates bearing different

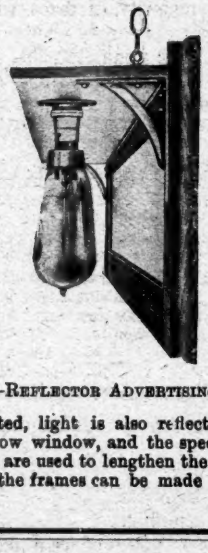


Fig. 4.—Reflector Advertising Sign.

legends—is illuminated, light is also reflected backwards upon the contents of the show window, and the spectator is not dazzled. Spring lamp-holders are used to lengthen the life of the metallic-filament lamps, and the frames can be made in any size desired.

Magnetic Storms.—An interesting discussion, aroused by the storm of September 25th, has been going on in *Nature* and elsewhere, between Sir Oliver Lodge and Dr. C. Chree. The former claims that the phenomena are consistent with and strongly support the theory that such storms are due to the emission of vast multitudes of electrons from the surface of the sun during a solar eruption, as evidenced by the appearance of "spots on the sun." The stream of electrons, projected at an immense velocity in the form of a conical beam, has a magnetic effect calculated to be equivalent to that of hundreds of millions of amperes, and as the beam passes over or near the earth, the magnetic disturbances pass from positive, through zero, to negative. Dr. Chree points out, however, that the disturbances are not limited to the declination, as Sir Oliver appears tacitly to assume, but take place also both in the meridian and in the vertical component of the earth's magnetic force, and the storm does not correspond to a disturbing force in a fixed direction, waxing and waning, but is irregular and oscillatory. Moreover, the average duration of such storms is not 9 hours, but 30 hours. Dr. Chree does not combat or support the emission theories, but calls for reservation of judgment and minute study of the records with an unbiased mind.

LEGAL.

Electric Installations in Mines.

[*Prosecutions by the Home Office.*]

Throughout the West of Scotland more than ordinary interest was taken in the prosecutions which, on Wednesday last week, at the instance of the Home Office, were taken against Mr. Andrew Salmond and Mr. James Salmond, the manager and general manager respectively of the Ferniegair pit, near Hamilton, belonging to the well-known coal-producing firm of Archibald Russell, Ltd. The complaints which were the outcome of the recent explosion at Ferniegair Colliery, by which three men lost their lives, were heard in the Hamilton Sheriff Court, the presiding judge being Sheriff Thomson.

The charge against the general manager (Mr. James Salmond) was that of having on June 27th, 1909, failed to have, in the completely insulated electric circuit in use for the cutting of coal in Ferniegair pit, an earth or fault detector kept connected up in the generating station, to show immediately any defect in the insulation of the system in use in the pit. Accused at a previous diet had denied the charge, and on Wednesday he was prepared to adhere to his ples, the counsel for the defence being the Hon. Wm. Watson, advocate, Edinburgh. At the outset of the proceedings, however, Mr. Wm. Thomson, Procurator Fiscal, Hamilton (who appeared for the Crown), intimated that he would not proceed with the charge against Mr. James Salmond, the general manager of the colliery.

Thereafter, the manager, Andrew Salmond (a son of the previous respondent), was called to the Bar, and the charges against him included the specific complaint already detailed, as libelled against his father, together with the further offence of having on June 27th, in the Virtuewell seam of Ferniefair Colliery, failed to keep the electric cables for the portable electric coal-cutting machine protected with either galvanised steel-wiring armouring, extra stout braiding, hose-piping, or other effective covering. The charge-sheet further bore that, on the date in question, the outer braiding of the trailing cables had been exposed and worn in different parts, and that there had been failure on the part of the respondent to have the exposure of the insulating sheath of cables promptly repaired. Accused denied the charge, and were defended by the Hon. Wm. Watson, advocate, Edinburgh.

Before witnesses were called, the Fiscal said he intended to drop the first charge, that of failing to have an earth or fault detector in connection with the generating station. It had now been ascertained that there was such a detector, although it was not at its proper place.

The chief witnesses for the Crown were Mr. J. M. Ronaldson, H.M. Inspector of Mines for the Western District of Scotland; and Mr. Robert Nelson, Electrical Inspector of Mines, London. The latter's evidence was regarded as the most important, and he deposed that following the explosion on June 27th, he had examined the electrical fittings of the pit on July 1st. Very special attention, he said, had been directed by him to the condition of the trailing cable attached to the coal-cutting machine in the Virtuewell seam. The trailing cable consisted generally of two copper wires covered by rubber insulation, on the top of which there was a cotton braiding. Above that again there ought to be a rope or leather covering. In the present instance he thought there were both layers of rope and leather constituting the outer covering to the trailing cable. In accordance with the provisions of the Act, the india-rubber insulation was not a proper protection for mechanical damage—the material protection being the rope or leather covering. As examined by him, after the explosion, the trailing cable was only partly effectively covered. He observed that at three or four parts of the cable the outer covering was entirely gone, and the only protection to the live wires was the cotton braiding and the india-rubber insulation. With this condition of affairs, three things might have occurred, all of which would have been prejudicial to the pit and the men working therein. First, there might have been a fall from the roof, which would have cut the cable in two. Then, if that happened when the motor was running there probably would have been sparking. Then, again, the cable might have been trampled under foot, and in that event a man standing on it would have sustained a shock. Such a shock might have been sufficient to kill a man. It altogether depended on the nature of the ground and the intimacy and closeness of the contact. Witness said he would not go the length of saying that the defects which he saw on the trailing cable had been caused by the force of the explosion. If such had been the case, he saw no reason why the explosion should have selected different parts of the cable and left the remainder.

In cross-examination by the Hon. Wm. Watson, Witness said that if the defects had been due to hard bodies or substances falling against the trailing cable, he would have expected that the underneath part of the covering would have been clean. He particularly noticed, however, that the exposed parts of the cable had the appearance of having been dragged along the floor of the mine, and had been subjected to contact with considerable coal dust. After explosions he had specially noticed that the rubber was very clean. Personally, he had inspected electrical plant in mines subsequent to three explosions, so that he could speak with some authority on the subject. He was appointed an electrical inspector of mines in November of last year, and he had considerable experience of electrical plants in connection with mines, both on the surface and underground.

In reply to Sheriff Thomson, Mr. Nelson said he was bound to admit that apart from the apparent defects in the outer braiding, the trailing cable appeared to be in good condition.

For the defence, evidence was given by John Wishart, electrical coal-cutting machineman, Larkhall, and Thomas Wright, machineman, William Place, Ferniegair, to show the precautions which the management of the colliery took to ensure that defects in the electrical fittings were promptly attended to.

Alexander Anderson, managing director of the firm of Messrs. Anderson, Boyes & Co., Ltd., electrical, mining and mechanical engineers, Motherwell, stated that he had examined the trailing cable on July 26th, a month after the explosion. He was then informed that the cable had undergone no alteration whatever from the condition it was in immediately following the blast. On the occasion of his examination he observed that there were two parts of the cable where it was exposed, and where the dielectric was specially exposed. There was a third instance where the covering was injured, but there was no exposure of the cables or the proper insulation. In his view, he regarded it as possible that these defects might have been caused in the course of the explosion. He did not make that statement with absolute certainty, but the defects to the cable could have happened through the *débris* being thrown about.

The Fiscal, in pressing for a conviction, said it had been sought to be made out that the defects found in the trailing cable, subsequent to the explosion, were caused by the blast. He maintained that such a contention was far from being sound, because they had the clear and conclusive evidence of the two mines inspectors to demonstrate that the condition of the cable was not of recent origin, but had been in existence before. They could not definitely say that these defects brought about the explosion, but of this they were certain—that there had been gross negligence on the part of the management of this colliery, resulting in the loss of three lives.

Sheriff Thomson, without calling upon counsel for the defence to address the Court, said he thought the trailing cable was undoubtedly quite sufficient to start with. Then they had it on evidence that the cable was thoroughly overhauled and repaired six weeks before the accident. From the evidence he thought it was proved that these defects were not caused by the explosion, but that they must have existed before it. Apparently they were not of quite recent origin. It was probable, but by no means certain, that they existed before the shift began, and, of course, it might be that they occurred in the course of the shift. If they existed before the shift began, then there was gross negligence somewhere. From the evidence led that day he did not find any neglect of duty on the part of the machineman, and on the assumption, which he stated previously, that the defect arose before the shift began, the only inference he could draw was that the negligence lay with the machineman primarily, and only secondarily, if at all, with the manager. So far as the latter official was concerned, he did not find that he was negligent in his supervision. He did not find that he was negligent in any system of examination or repairing, and he did not hold he was negligent in the enforcement of any rule. In the whole circumstances he could not see that any responsibility had been brought home to the respondent, and therefore he must dismiss him from the bar.

The verdict of the Sheriff was received with some applause in Court.

Western *v.* Barr.

In the King's Bench Division, on Monday, October 18th, judgment was given in default of appearance of the defendants in the action of Messrs. G. Western & Sons *v.* Messrs. Louis Mortilmas Barr and Co. Plaintiffs claimed the sum of £119 15s. 6d. in respect of supplying electrical fittings, &c., to defendants' premises.

Mr. Justice Hamilton ordered judgment to be entered for the amount claimed, and costs.

McMullen *v.* Sunderland District Electric Tramways Co., Ltd.

At the Sunderland County Court, on 13th inst., before Judge O'Connor, Isabella McMullen, of Silksworth, sued defendant company for £25 damages in respect of injuries received.

Mr. H. M. McLean, for the defendant company, admitted liability to the extent of £15, which had been paid into Court.

The Plaintiff stated that on April 30th last while crossing the road at Silksworth she was injured by a falling wire. She was bruised, and received a severe shock, and was in bed for a month.

After hearing further evidence, his Honour gave judgment for the plaintiff for £23 with costs.

Trenery *v.* Liverpool Corporation.

In the Liverpool Court of Passage on Wednesday last week, before Mr. W. F. K. Taylor, K.C., and a common jury, the hearing was concluded of an action brought by Mrs. Trenery against the Liverpool Corporation to recover damages for personal injuries. Mr. Rigby Swift was counsel for the plaintiff, and Mr. Wooll for the defendant Corporation. The case for the plaintiff was that on the night of Saturday, June 19th, Mrs. Trenery, with her husband, boarded a Smithdown Road tramcar at the junction of Hope Street and Myrtle Street. The car was very full, people standing up inside as well as on the platform. Plaintiff secured a seat, and her husband

stood near the door holding a strap. She intended to alight near Parliament Street, where there was a request stop, and she rose from her seat, but on the instant the car stopped and the passengers were flung about, and plaintiff was thrown to the floor. She was picked up in a collapsed condition, and developed floating kidney, with which she had been in bed for several weeks.

Mr. Wooll, for the Corporation, urged that the Corporation could not be held liable, seeing the car had been stopped suddenly out of consideration for the public. He held that every tramcar passenger must be prepared for a sudden stoppage. The conductor rang the emergency bell of five rings as he saw a crowd of people waiting to get on the car. He called Sir James Barr, Dr. Paul and Dr. Brannigan to say that the effect of such a fall would not give rise to a floating kidney, and it must have been contracted prior to the accident.

John A. Johnson, the tramcar conductor, said he stopped the car by using the emergency signal in order to avoid scuffling between the passengers, as might have been the case if they went to Granby Street, where a number of people were waiting. Plaintiff was the only one who complained.

Mr. Wooll quoted one of the Tramway by-laws, apprising passengers that they must be prepared for sudden stoppages whenever it was necessary to avoid impending danger.

Mr. Rigby Swift complained of the system in vogue in the tramways department, whereby the reports of their officials were sent to the town clerk's department, and were, therefore, not accessible to the legal advisers of injured passengers for the purpose of litigation against the Corporation.

The jury returned a verdict for the plaintiff, assessing the damages at £153 and costs. Judgment was entered for that amount.

Mr. Wooll asked for a stay of execution, on the ground that there was no negligence, but his Lordship refused to grant it.

Electricity in Fife Coal Pits.

Sheriff Shennan, Dunfermline, has dismissed the objections to the relevancy of the charge against the manager and representative of the Fife Coal Co. and the certificated manager at Foulford Colliery. They are charged with having contravened the special electrical rules by having defective apparatus in Foulford Colliery. It was contended that the plant and apparatus were installed before the coming into force of the special rules for the use of electricity in mines. Special Rule 55, the Sheriff points out, permits such plants to be continued in use unless the inspector should otherwise direct. It is contended, on the other hand, that the Inspector of Mines did otherwise direct by letter, and the prosecutor would fail if he could not prove the notice.

Mr. D. Connel, on behalf of the Fife Coal Co., asked his Lordship to give them time to have their evidence collected, and the Sheriff fixed proof for November 18th.

Babcock & Wilcox, Ltd., *v.* Spearing.

In the Court of Appeal on Saturday, the 16th inst., Lords Justices Vaughan-Williams, Buckley and Kennedy had before them the case of Babcock & Wilcox, Ltd., *v.* Spearing, on the appeal of the plaintiffs and cross-appeal of the defendant against an order of Mr. Justice Bucknill in Chambers affirming an order of the Master. In the course of the hearing an advertisement which appeared in the Electrical Review was referred to.

Mr. S. H. Emanuel, for the plaintiffs, said that the point involved in the two appeals was really the same. It was whether certain documents disclosed in the defendant's affidavit of documents should be open for inspection by the plaintiffs. The defendant opposed inspection on the ground that, as he alleged, the documents contained nothing which would assist the plaintiffs' case. The Master, in Chambers, ordered that one of the documents, namely, an agreement dated July 27th, 1908, and made between the defendant and Edwin Danks & Co. (Oldbury), Ltd., should be open for inspection, but as to a batch of other documents he refused inspection. This order Mr. Justice Bucknill affirmed. The facts were as follows: On May 16th, 1903, the defendant, Arthur Horace Spearing, entered into an agreement with the plaintiffs for the settlement of an action for alleged infringement of patents which was pending against the defendant and others at the suit of the plaintiffs. Amongst other things, it was agreed by the defendant that he would not undertake the sale or manufacture of any water-tube boilers in competition with the plaintiffs. There was a proviso in the agreement that so far as sale was concerned, that restriction should only apply for a certain period, which period had now elapsed. The agreement, however, remained valid for ever in regard to the undertaking not to manufacture. The question of whether that agreement was reasonable and valid was the subject of an action in the Chancery Division, in which specific performance was granted. The present action was for alleged breach of the agreement not to manufacture water-tube boilers, an injunction being asked for. Amongst other things, the defendant had published an advertisement in the Electrical Review, in which he represented himself as a manufacturer of water-tube boilers with works at Oldbury, Birmingham, and the plaintiffs alleged that he had tendered in competition with them for the manufacture of such boilers. In other words, they said that he was manufacturing or undertaking the manufacture of water-tube boilers. In reply, the defendant said that he was not manufacturing or undertaking the manufacture of boilers, but that he was selling them under an agreement with Messrs. Edwin Danks & Co., Ltd., of Oldbury, Birmingham. Defendant admitted that the Water-Tube Boiler and Engineering Co., of Oldbury, was himself.

Lord Justice Buckley: The defendant says that Messrs. Danks, under an agreement with him, are entitled to manufacture. They may be his agents for manufacture.

Mr. Emanuel: Yes, and we say that we are entitled to have inspection of that agreement. The Master who saw the agreement so held, but he refused inspection of tenders by the defendant, which we say are tenders for manufacture.

Mr. Disturnal, for the defendant, submitted that the plaintiffs were not entitled at this stage of the litigation to inspection of either the agreement or the tenders. The whole question was whether the defendant was undertaking to manufacture, and that would have to be decided at the trial. The defendant's case was that he only sold boilers which were manufactured by Messrs. Danks, who were an old-established firm of boiler makers. The documents when examined so far from showing that the defendant was manufacturing showed that he was not manufacturing.

Lord Justice Kennedy: Then you ought to be only too delighted to show them.

Mr. Disturnal submitted that as Messrs. Danks were rival manufacturers with the plaintiffs, the defendant ought not to be called upon to disclose the tenders, which would show the names of the customers and the prices.

After some further discussion, their Lordships intimated that in their view the agreement and all the other documents in question ought to be open for inspection, and it was directed that the plaintiffs should have inspection, but that in the case of tenders they should be furnished with copies with the prices and names of customers left out. Order accordingly.

Lingwood *v.* Braulik.

In the City of London Court, on Friday, before Judge Lumley Smith, K.C., a claim was made by Frank Lingwood, clerk, 93, Elboro Street, Southfields, against Mr. George Braulik, proprietor of the Victoria Electric Works, 8, Lambeth Hill, E.C., to recover the sum of £3 5s. wages due, and damages for alleged wrongful dismissal.

Plaintiff said he was in the defendant's service for three years as a clerk, latterly at 32s. 6d. a week. He had compiled a book of cost prices of all the electrical goods dealt in by the defendant, and when the defendant made the discovery, he was instantly dismissed from his employment. He had prepared the book for use in the office. It was not done for use in a competitive firm's service. He was now employed by the General Electric Co., Ltd. He had since burned the book.

Defendant said he was very surprised to find that the plaintiff had compiled a cost prices book. They were all of a private and confidential nature, and included the names of the manufacturers from whom he bought all his electrical goods. Plaintiff had collated the information from index cards, and was guilty of a breach of confidence. He might have given the information to any competitors. If the plaintiff had parted with the cost prices to other firms, defendant's business would have been got away from him, and his prices cut.

Judge Lumley Smith said that betraying one's master's confidence was not consistent with a proper discharge of duty. If it had been merely a record of what different firms charged he would not have thought anything of it, but it went further than that. It was a record of transactions which the master had been having for some considerable period with different firms, and that could only be useful for the purpose of being carried away after he left the service. He thought it amounted to a breach of confidence. On the whole, the master was justified in dismissing the plaintiff. Judgment for the defendant, with costs.

British Westinghouse Electric and Manufacturing Co., Ltd., *v.* Braulik.

Mr. Justice Joyce in the Chancery Division on Monday, delivered a considered judgment in this action which was brought by the plaintiffs for an injunction to restrain the defendant from infringing letters patent granted to them in 1902 for an improvement in arc lamps. The facts sufficiently appear from the following judgment:—

Mr. Justice Joyce said the invention claimed by the patent in this case is: "An arc lamp having downwardly-pointed electrodes, and provided with both downward and horizontal feed mechanism so arranged that a certain amount of operation of the horizontal-feed mechanism takes place before the downward-feed mechanism is permitted to operate, subject to the disclaiming note." The disclaiming note is: "The lamps to which this, my invention, applies, are of the type in which the current is supplied to the electrodes through electrode-holders in which the upper ends of the electrodes are firmly clipped, and which are capable of being lowered simultaneously through the same distance, and about one of which the corresponding electrode can swing under the action of a device acting near its lower end, and I limit my claim to lamps of this description." Apparently the original claim was too wide, and by the disclaiming note the plaintiffs restrict the application of their invention to a particular kind, or particular kinds, or to a specified type of arc lamp, in such arc lamp claiming any and every arrangement whereby a certain amount of the operation

of the "horizontal feed mechanism," a term previously defined, takes place before the "downward feed mechanism," a term also previously defined, is permitted to operate. He does not claim some specified or any particular apparatus or mechanism to effect the purpose indicated. The patent is not for any particular contrivance or device to effect a certain object, but generally for every mode of effecting that object in any arc lamp having certain specified characteristics. The specification, by letterpress and drawings, in which it is admitted on the part of the plaintiffs, for it could not be denied, that there are several errors and inaccuracies, purports to show a mechanism quite easy to contrive, the object being given whereby such an arrangement as claimed can be effected in the particular type of arc lamp to which the invention is intended to apply, but it does not claim this specific mechanism or any other particular mechanism. Now, assuming the validity of the plaintiffs' patent, if I rightly understand what the defendant is doing, it appears to me that his lamp is an infringement. But I think the real and serious question in the present case is the validity or otherwise of the plaintiffs' patent, and this is impugned upon two grounds:—First, it is said that this patent is invalid for want of subject matter; and, further, that the patent was completely anticipated by the invention claimed in Graham's specification. As has been said, and as I have said before, I do not intend to describe and explain the details of these various lamps or to discourse upon the scientific nature of what I do not understand. Lord Justice Bowen pointed out in the Fleet Case in 2 *Times* Law Reports, that it is no part of the function of the Court to qualify itself as an expert. The Court, in such a case as this, has to act upon the evidence of experts whose qualifications and opinions are tested by cross-examination, and the Court weighs the evidence so given and tested. Thus proceeding, to my mind, the result of the evidence is this: That there being a well-known contrivance or arrangement, common, if not universal, in the kind of arc lamps in ordinary use, this patent is taken out for the application of such contrivance or arrangement *mutatis mutandis* to a precisely similar, if not the very same, purpose in a particular specified type of arc lamp, namely, that described in the claim as limited by the disclaiming clause. This contrivance or arrangement as employed in the vertical arc lamp in common use at the date of the patent is variously described in the evidence. To make use of it in the manufacture of any new or other type of arc lamp, I think was a perfectly natural and the obvious thing to do, and there does not appear to have been the slightest difficulty in doing it. It might, no doubt, have been done in various ways, in any one of which there might possibly be invention and consequently subject matter for a patent; but, in my opinion, there could not, in the circumstances, be a good patent merely for the use in any new or special kind of arc lamps of that which was already known and commonly adopted in the ordinary arc lamps for practically the same purpose. Rightly or wrongly, I think the objection founded on want of subject matter to be, in the circumstances, a good and valid objection to the patent, and that is what is claimed; there is no invention to support the patent, and consequently, in my opinion, this action fails. As to the other objections, I do not think it can be denied that the invention described in Graham's American specification is within the claim of the patent in question, and that the lamp described in such specification would work in the manner which the patentee claims as his invention, and for which he has obtained his patent. Upon the whole, I think that the plaintiffs' patent, if otherwise valid, has been anticipated by Graham's patent, if not by others; but the ground upon which I decide this case is, that in the so-called invention of the patentee as claimed, there was no real invention or subject matter to support a patent. The result is, that I dismiss the action with the usual consequences.

Mr. Gray: I ask your Lordship to certify that the particulars of objections were reasonable and proper. I dare say my friend and I can agree the certificate, if your Lordship would prefer it in that form.

Mr. Justice Joyce: If you agree, I will certify it.

Mr. Russel Clarke: We should have to agree.

Mr. Justice Joyce: Is there any question about it?

Mr. Russel Clarke: I do not think there is.

Mr. Gray: There were some things which were not referred to, and, of course, I cannot get my certificate as to those.

Mr. Russel Clarke: I do not suppose there will be any difficulty.

Mr. Justice Joyce: There will be liberty to mention it to me if you cannot agree.

Mr. Gray: I do not think it will be necessary.

Mr. Justice Joyce: Very well, then the action will be dismissed with costs.

We learn from the British Westinghouse Co. that they have lodged notice of appeal.

Holmes *v.* Associated Newspapers, Ltd.

Mr. Justice Neville this week was occupied in the Chancery Division with the hearing of a patent action—Holmes *v.* Associated Newspapers, Ltd.—by which the plaintiff claimed an injunction in respect of an alleged infringement of letters patent No. 9,802 of 1898, granted for an invention for a combination of electric motors for driving printing presses, &c.

The plaintiff was represented by Mr. Walter, K.C., and Mr. J. Hunter Grey; and Mr. Astbury, K.C., and Mr. Kerley appeared for the defendants.

Mr. Walter explained that the action was brought in respect of the motors of an electrically-driven printing press exhibited by the defendants at the White City and supplied to them by Kohler Bros., of U.S.A. and England, who, it was understood, took all responsibility in the matter. Having explained the methods of modern printing, the speed at which modern presses worked, the great length of paper used, and the consequent necessity for smooth working, counsel said the patent in question was for a system of coupling up electrically-driven motors for the purpose of driving printing machinery, by which method the full power of the motor could be applied without shock, with the advantage that the armature shaft of the main motor was in motion before it was called upon to exercise its full driving power—that was to say, that at the same time that a small motor was doing its work, an overlapping took place, and the current began to come on the large motor. While the small motor was running doing its work, the current was turned on to the large motor, causing the latter to speed up until it overlapped the small motor, and eventually took up the load. By this arrangement a gradual movement was obtained, and the small motor was in action until up to the time when the full power came on. The result was that there was no jerk. The attempt to produce a slow movement by driving from a single large motor when coupled with a printing machine resulted in danger not only to the printing but also to the motor, due to overheating. In order to start a large motor, as his Lordship might understand, there was an enormous amount of power necessary to overcome the inertia of the printing press. The full current went through the machine, and if the whole of the energy was turned on at once, part was turned into heat and was apt to melt the insulation and destroy the armature. It was in order to provide against those difficulties that the patent in question was directed. To carry this principle into effect they provided a direct and simple connection between the main shaft of the driving motor and the spindle of the printing press and then between the two motors. Then by means of a reversing gear the auxiliary motor could be left at rest when the big motor gathered speed and took the load. That was the invention which the plaintiff claimed was both novel and useful. A number of specifications had been put in which were relied upon as anticipations, but none of them seemed to have accomplished what the plaintiffs had done by the same means, and he (counsel) would deal with them when he had heard what his friends on the other side had to say about them. As he understood Mr. Astbury accepted his explanation of the working of the invention, he would be able to deal with his witnesses quite shortly.

Mr. Dugald Clerk, called in support of the plaintiff's case, in answer to Mr. Walter, said that he had had considerable experience of electrical contrivances and machinery. He had read the specification of the invention in question, and it dealt with the difficulties of working modern printing presses electrically.

Mr. Walter: What are those difficulties?

Witness said that modern printing presses carried paper in very large rolls, and the paper was usually of a very tender nature. A very little jerk would break the paper, and it was consequently very important that every press should be started very gently, and it was also necessary as well as starting the press gently, that full power should be obtained almost immediately after the paper had been adjusted before the press was started. Those essentials were given by the plaintiffs' combination. The arrangements in the specification were such that all the operations must follow in a mechanical sequence, and therefore you got a smooth starting. The main motor spindle ran faster than the press spindle, and therefore there was leverage. With a small motor the leverage the small motor had on the large motor was much less than the leverage of the large motor on the press. Having a mechanical series there was very little leverage, and the result was that you got a smooth starting. The tendency was to start the motor smoothly and with very little jerking. He had looked at all the papers connected with the case very carefully, and he found all the essentials of the plaintiff's specification in the defendants' machine. He did not find the plaintiff's invention described in any of the prior specifications relied upon as anticipations.

Cross-examined by Mr. Astbury, Witness said that when using only one motor the difficulty at starting was the keeping up of the slow speed, so as to get gradually up to the high speed. Much greater power was required to start the machine after it had been at rest than was required to keep it going once it was in motion. It followed, therefore, that when using one motor, if the energy was sufficient to enable the machine to start, it would take up its power much too quickly in order to enable it to do the preliminary operations. It would produce a check, and a check that would tend to tear the paper. In some respects the action of the plaintiffs' and defendants' machines was different. The sequence of action was not always the same.

Evidence was given by Mr. Madge, of the *People*, and other gentlemen connected with newspapers, who spoke to the utility of the plaintiff's invention and the impossibility of using electric motors for printing machines before, and the hearing was adjourned.

On Wednesday Mr. Walter, K.C., summed up the case for the plaintiff. Without opening the case for the defence, Mr. Astbury, K.C., proceeded to call his evidence, and Mr. Henry Hopwood, of the Patent Office, gave formal evidence as to the production of certain documents of 1898 that had been produced and were relied upon by the defence. The hearing was again adjourned.

Northern Electrical and Ventilating Co., Ltd., *v.* D. Yates Gregory.

Before Mr. W. F. K. Taylor, K.C., presiding judge, at the Liverpool Court of Passage, on October 18th, plaintiffs claimed from defendant, who was a theatrical manager of Douglas, I.O.M., the recovery of £51 12s., the price of a dynamo supplied by them.

Plaintiffs' case was that in May they delivered to Gregory a

dynamo complete with all accessories, without a warranty, which he required for the purpose of a bioscope entertainment at Douglas. The charge made by plaintiffs was £51 12s., which Gregory now refused to pay. The company declared that the dynamo was used in the Isle of Man all the season without complaint, and that it was one such as defendant required. Defendant, however, offered to pay £25 for the dynamo, which was refused. On the writ being issued, a counterclaim was put in for the price of an electric lighting engine, which plaintiffs had supplied him, and which he declared was defective. Evidence was given in support of plaintiffs' case.

Defendant, in evidence, asserted that the dynamo was purchased by him with a warranty that it was a first-class electrical machine, and that it was competent to accomplish the work required of it. It was, however, not a first-class machine, and could not do the work, and he claimed that it was not worth more than £30, which had been paid into Court.

Mr. Kennedy (for plaintiffs) pointed out that no complaint had been made about the engine until the claim was put in in respect of the dynamo.

Mr Cuthbert Smith (for defendant) replied that his client had been away. He asked that a substantial amount should be taken off the sum of £68 15s. which had been paid for it, because the machine was older than it was represented to be, and had not given satisfaction.

His Lordship gave judgment for plaintiffs on the claim for £43 12s., and also found for them on the counterclaim, with costs.

Armorduct Manufacturing Co. *v.* The General Incandescent Co.

On Monday Mr. Justice Ridley and a special jury in the King's Bench Division had opened before them an action, in which the Armorduct Manufacturing Co., of London and Birmingham, sued the General Incandescent Co., of Great Eastern Street, E.C., for damages for alleged conversion by the defendants of certain goods belonging to plaintiffs.

Mr. Montagu Lush, K.C., said the plaintiffs, as well as the defendants, had depôts in different towns in the country. In 1904 a Mr. S. Haynes, who traded as "The Electrical Stores, S. Haynes, agent," was plaintiffs' agent, but there appeared to be a discrepancy between the goods in his stock and the money he had paid over, and it was found that he had also been acting as the defendants' agent. His agency with the plaintiffs was terminated, and afterwards he was appointed as manager of the defendants' depôts at Nottingham and Derby. The allegation of plaintiffs was that the defendants had received the £170 (which was the value of the goods plaintiffs' had missed), and that amount had been paid into their account by Haynes, acting as their agent. Defendants denied the allegations. Counsel added that judgment had been secured against Haynes for £160, but it had not been satisfied.

On defendants' behalf, Mr. Lewis Thomas, K.C., contended that there was no case to go to the jury.

His Lordship, however, said he thought there was. Haynes, acting quite rightly, told the defendants that he had sold certain of plaintiffs' goods, but acting in accordance with his agreement, he paid all the money he had received to his employers, the defendants, who should have paid plaintiffs their share. He thought it was plain that defendants kept the money, and the case was, in his opinion, undefended.

The hearing was resumed on Tuesday, when Mr. W. J. Moore, the managing director of the defendant company, gave evidence.

The jury returned a verdict in favour of the plaintiffs, and his Lordship entered judgment accordingly, ordering the payment to plaintiffs of £58 8s. and an inquiry for account as to the balance that might be due.

A stay of execution was granted.

TRADE NAMES AND TRADE DESCRIPTIONS.

By A BARRISTER-AT-LAW.

Every trader who relies on his good name and the good name of the article which he deals in to assist in the promotion of his business, is naturally solicitous with regard to the way in which the law will protect him. It is true he may become the proprietor of a registered trade mark; but it is not proposed, in the present article, to deal with the English law of trade marks—properly so called. What it is desired to show is that, according to the law of England, the fraudulent use of a trade mark or name will be made the subject of judicial control.

Apart altogether from the law of trade marks, the English Courts have and will exercise an inherent jurisdiction to prevent one trader adopting the title of another's goods with a fraudulent intent. Again, the law of England will restrain what is known as "passing off." Thus, suppose the steel made by a particular firm were to become known throughout England as "Elephant Steel"—so well known that anyone buying "Elephant Steel" would know, or assume, that it was the product of the firm in question. Suppose that, in these circumstances, another steel merchant were to stamp his bars with the words "Elephant Steel," the Courts would interfere to prevent his committing this fraud upon the public. This principle would be held to apply whether plaintiff or defendant was a foreigner trading in England. So it is apprehended that if an American firm of steel merchants had acquired what we may term a customary title to a certain name, their use of it would be protected. Again, if an English firm had acquired the right we have indicated, it would not be competent for the American firm to make infringing articles in America, and import them into England to deceive "His Majesty's subjects." Such a proceeding would be restrained and prevented, if the offenders could be got hold of.

The fact that the misuse of a name will be prevented was well illustrated in the case of Aerators, Ltd., *v.* Automatic Aerator Patents, Ltd., which was heard by Mr. Justice Farwell early in June, 1903. There the plaintiff company, who are the proprietors of the well-known "sparklets," sought to restrain the defendants from using the name "Automatic Aerator Patents, Ltd.," on the ground that it so nearly resembled the name of the plaintiff company as to be calculated to deceive. Sec. 20 of the Companies' Act provides that no company shall be registered under a name identical with that by which a subsisting company is already registered, or so nearly resembling the same as to be calculated to deceive, except in certain cases, which are not material to the present discussion. It follows from this that a company has greater rights than an individual in respect of names which are identical, for while John Smith cannot always prevent another John Smith using his own name, John Smith, Ltd., could prevent the registration of any other company as John Smith, Ltd. Mr. Justice Farwell, however, declined to grant an injunction, for the reason that, giving words their ordinary meaning, no one was likely to be deceived. Further, it was not competent for any company or person to claim the sole proprietorship of any word in common use. "For example," said his Lordship, "suppose a company had registered the name of 'Motors, Ltd.,' and another the name of 'Automobiles, Ltd.,' it appears to me impossible to say that they could thereby prevent all other companies from using as part of their titles these two words, which, so far as I know, are the only words which represent the fashionable locomotives of the day, although their sole trade was the manufacture or sale of motors or automobiles. . . . . In considering whether a name is calculated to deceive, it is, as I have said, material to see what that name is; and if the name is simply a word in ordinary use, representing a machine or an article of commerce, the probability of deception is out of all proportion less than it would be in the case of an invented or fancy word, or even of the name of a place."

Even if a man uses his own name in connection with his business, with intent to defraud, the Courts will prevent him.

In Holloway *v.* Holloway, 13 Beav. 209, the defendant, Henry Holloway, commenced selling pills as H. Holloway's pills in boxes similar to those of the plaintiff, Thomas Holloway, with a view to passing off his pills as the plaintiff's. He was restrained by injunction. Again, where a man named Day having obtained the authority of one Martin to use his name, set up in business as Day & Martin, and sold blacking in bottles with labels similar to those of the well-known firm, he was restrained by injunction. These two cases illustrate the proposition that "fraud vitiates everything." In the absence of fraud, however, a man may use his own name in his own business, no matter what may be the consequences to his neighbours. The case of Turton *v.* Turton may be regarded as a leading authority in support of this proposition. The plaintiffs had for many years carried on the business of steel manufacturers in Sheffield under the style of "Thomas Turton and Sons." In 1886 they were registered as a company, and added the word "Limited" to the above title. The defendants were John Turton and his two sons. John Turton had commenced a business very similar to that of the plaintiffs in 1869, in partnership with one Lawton, under the style of "Turton and Lawton." In 1875 Lawton retired, when John Turton took his sons into partnership under the style of "John Turton & Sons." Owing to the confusion caused by the similarity of names, the plaintiffs sought an injunction to restrain the defendants from carrying on the business of steel merchants and manufacturers under this name, or any name so closely resembling their own as to be calculated to deceive. Much evidence was called as to the confusion which had arisen in Sheffield, but the defendant deposed that the new name of his firm had been adopted for the sole purpose of making known the fact that his two sons had become partners. When the case reached the Court of Appeal, their lordships refused to grant an injunction. The late Lord Esher said:—

"It is not alleged, and it certainly is not proved, that the defendant did anything in the way of his trade which tended to give any other meaning to the name in which he carried on his business, or which could give any other meaning to it, than the mere fact that he did carry on his business, and was in partnership with his sons. The plaintiffs have no right to say a man may not use his own name. Upon principle I should say it is perfectly clear that if all a man does is to carry on the same business, and to state how he is carrying it on, that statement being the simple truth, and he does nothing more with regard to the respective names, he is doing no wrong, and there is no *prima facie* case against him."

The law on this subject may be thus summarised:—

1. A man will not be restrained from simply carrying on business in his own name, even though confusion may arise.

2. A man will be restrained from carrying on business in his own name dishonestly, *i.e.*, when he not only uses his own name, but uses it in such a way (that is, in conjunction with other circumstances) as to represent that his business or his goods are the business or goods of another trader.

3. If a trader has a trade name for his goods which denotes those goods solely in the market, and distinguishes his goods from similar goods of other traders, so that the trade and the public, when asking for goods under that name, mean and intend to get particular goods emanating from one particular trade source (although they may not know such trader's name), then he is entitled to be protected by the Court against other traders using that name in such a way as to be calculated to pass off other goods as his.

The doctrine of "passing off" may also be illustrated by reference to numerous decisions. In one case, it was held that there was no monopoly in the use of the word "magnolia" as applied to metal, as it had become well known in the trade as a substance peculiarly adapted for bearings in machinery. Where, however, a brewer had manufactured ale at Stone for a number of years, so that his ale came to be known as "Stone ale," an injunction was granted to restrain the defendant, who had only recently come to the town, from selling ale under the appellation of "Stone ale," or "Montgomery Stone ale." (Montgomery *v.* Thompson (1891), A.C., 217.)

As a trade name is really acquired through the laches of the market, so, too, a trade name may be lost through the laches of the owner. If the owner of a trade name allows his rivals to use his trade name on their goods without objection it will cease to be his trade name. It will become, in legal phraseology, *publici juris*, *i.e.*, common property. What is the test whereby to ascertain whether that which was originally a trade name has become *publici juris*—*i.e.*, common property? It becomes so when it ceases to be distinctive—when it ceases to denote solely the original man's goods in the market. Of course, it ceases to denote his goods solely if it is habitually used on similar goods by other traders. But this state of things—habitual use by other traders—can only arise with the acquiescence, *i.e.*, by the sanction, of the original trader. If when he becomes aware that another or others are using his trade name he takes legal proceedings to stop that use, presumably he will succeed; if he does not, then he will be held to have acquiesced in what is being done, and will be precluded from interfering afterwards. If, therefore, a trader becomes aware that his rights to his trade name are being invaded, he must take steps promptly to assert and protect those rights, if he wishes to preserve them, and he must not content himself with a mere protest, or even with a threat of legal proceedings; but if the infringer sets him at defiance, he must follow up his threat with the proceedings he threatened.

In the generality of cases between trade rivals which come before the Courts the plaintiff says: "I complain that you have passed off your goods as mine, which they are not." In some cases, however, the plaintiff says: "You are passing off my goods as yours, which they are not." It seems that the Courts are inclined to prevent the latter form of piracy, just as much as they will prevent the former.

The case of Bullivant *v.* Wright, 1897, 13, T.L., R. 201, illustrates what kind of passing off will be restrained by the Courts. The plaintiffs were wire-rope manufacturers and contractors for aerial tramways and cableways. The defendants, who were also wire-rope manufacturers, published a trade catalogue, which contained (*inter alia*) two diagrams, or pictures, of aerial cableways which had been designed and erected some years before by the plaintiffs' predecessors in title. The plaintiffs alleged that the publication of these diagrams by the defendants in their catalogue was a representation that the same had been erected by the defendants. They claimed an injunction to restrain the further publication of the catalogue, and an order for the delivery up of all the catalogues in existence. As a matter of fact, what the defendants had done was to supply new wire cables as they were required during several years. Mr. Justice Kekewich, in the course of his judgment, said: "No reasonable man, seeing these pictures in a book of this kind, would have any doubts that the defendants intended it to be understood that they had erected the tramway. It is as distinct a representation to that effect as if it had been expressed in plain language. . . . If it is proved to the satisfaction of the Court in a case of this kind that the defendants did in truth say that the plaintiffs' goods were theirs, I think that, as between rivals in trade, the Court would be justified in drawing the inference that the wide circulation of such a statement would necessarily damage the plaintiffs quite as much as in the ordinary case of the passing off of goods." These observations seem to show that if the plaintiffs had been able to show that they had themselves erected the cableway, they would have had judgment; but the case was decided against them on another point. We may draw the following conclusion:—That if Jones sells or advertises boots and shoes manufactured by himself in such a way as to make the public believe they are Brown's, and so obtain the benefit of Brown's good name, he may be restrained by injunction.

In a Scotch case, Parozone Co., Ltd., *v.* Johnson Gibson (1904, 21 R.P.C. 317), the plaintiff company invented and applied the name "Parozone" to a bleaching fluid made by them, and it was admitted that they were entitled to the exclusive use of that name as indicating fluid manufactured by them only. Gibson, another trader, also made a bleaching fluid, but said that he never sold it as "Parozone," and when asked for that substance explained that his fluid was not "Parozone." The plaintiff company proved that on five occasions to two persons Gibson, or his servants, sold his fluid in answer to a request for "Parozone," and without explanation. They further proved that Gibson pointed out to two former shop-girls the jar where he kept "Parozone," and that it was a matter of daily occurrence for Gibson's fluid to be sold to customers who asked for "Parozone" without explanation. Gibson proved that on some occasions he had explained that his bleach was not "Parozone." It was held on these facts that the plaintiff company were entitled to the injunction.

It is next necessary to deal with the provisions of the Merchandise Marks Acts, which prevent a trader from passing off his goods as those of another trader, and make him criminally liable. The first section of the Merchandise Marks Act, 1887, makes it an offence, among other things: (1) to forge a trade mark; (2) to falsely apply to goods any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive; (3) to apply any false trade description to goods; and (4) to cause any of these things to be done. But it is not to be an offence if the person charged proves that he "acted without intent to defraud." Trade mark in this and the provision next referred to means a trade mark registered at the Patent Office, but it also includes certain foreign and Colonial trade marks, for which the Act itself must be consulted. Sec. 2 (2) makes it an offence to sell or expose for sale, or possess for the purposes of sale or any other trade purpose, any goods or things to which a false trade mark or a false trade description is applied, or to which any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive is falsely applied. But it is not to be an offence if the person charged proves—"(*a*) that, having taken all reasonable precautions against committing an offence against this Act, he had, at the time of the commission of the alleged offence, no reason to suspect the genuineness of the trade mark, mark, or trade description; and (*b*) that, on demand made by or on behalf of the prosecutor, he gave all the information in his power with respect to the persons from whom he obtained such goods or things; *or* (*c*) that otherwise he had acted innocently."

Forging a trade mark is defined by the Act as follows: "A person shall be deemed to forge a trade mark who either—(*a*) without the assent of the proprietor of the trade mark makes that trade mark, or a mark so nearly resembling that trade mark as to be calculated to deceive; or (*b*) falsifies any genuine trade mark, whether by alteration, addition, effacement or otherwise; and any trade mark or mark so made or falsified is in this Act referred to as a forged trade mark. Provided that in any prosecution for forging a trade mark, the burden of proving the assent of the proprietor shall lie on the defendant."

Applying a trade mark or mark or trade description to goods is defined by the Act: "(1) A person shall be deemed to apply a trade mark or mark or trade description to goods who (*a*) applies it to the goods themselves; or (*b*) applies it to any covering, label, reel or other thing in or with which the goods are sold or exposed, or had in possession for any purpose of sale, trade or manufacture; or (*c*) places, encloses, or annexes any goods which are sold or exposed, or had in possession for any purpose of sale, trade or manufacture, in, with, or to any covering, label, reel, or other thing to which a trade mark or trade description has been applied; or (*d*) uses a trade mark or mark or trade description in any manner calculated to lead to the belief that the goods in connection with which it is used are designated or described by that trade mark, hall mark or trade description; (2) The expression 'covering' includes any stopper, cask, bottle, vessel, box, cover, capsule, case, frame or wrapper, and the expression 'label' includes any band or ticket. A trade mark or mark or trade description shall be deemed to be applied whether it is woven, impressed, or otherwise worked into, or annexed, or affixed to the goods, or to any covering, label, reel, or other thing; (3) A person shall be deemed to falsely apply to goods a trade mark or mark who without the assent of the proprietor of a trade mark applies such trade mark, or a mark so nearly resembling it as to be calculated to deceive; but in any prosecution for falsely applying a trade mark or mark to goods, the burden of proving the assent of the proprietor shall lie on the defendant."

A trade description is defined by Sec. 3 of the Act as any description, statement, or other indication direct, or indirect, as to certain things not material for the present purpose. A false trade description is defined by the same section, as follows:—"The expression 'false trade description' means a trade description which is false in a material respect as regards the goods to which it is applied, and includes every alteration of a trade description, whether by way of addition, effacement, or otherwise, where that alteration makes the description false in a material respect; and the fact that a trade description is a trade mark, or part of a trade mark, shall not prevent such trade description being a false trade description within the meaning of this Act. The expression 'goods' means anything which is the subject of trade, manufacture or merchandise. The expressions 'person,' 'manufacturer, dealer or trader,' and 'proprietor,' include any body of persons corporate or unincorporate. The expression 'name,' includes any abbreviation of a name." The description must be false "in a material respect"—which means that it must be materially or substantially false, and not necessarily wholly false; and it may be remarked that the section does not extend to mere verbal descriptions.

The first offence described consists in doing something illegal to goods; the second consists in dealing with goods to which something illegal has been previously done. The first is aimed mainly at manufacturers, the second at sellers, wholesale or retail, not being themselves the manufacturers of the fraudulent goods.

As to the first offence, it is not to be held to be committed when the person charged proves (the burden of proof is, of course, on him) that he "acted without intent to defraud." This does not mean intent to defraud any particular purchaser or other individual, but intent to defraud generally by passing off an article as different to that which it really is. It does not cover what are mere cases of inaccuracy of description.

The following case is a convenient illustration of the way in which this Act is interpreted by the English Courts. It has been laid down that where trade usage confines a generic name to one

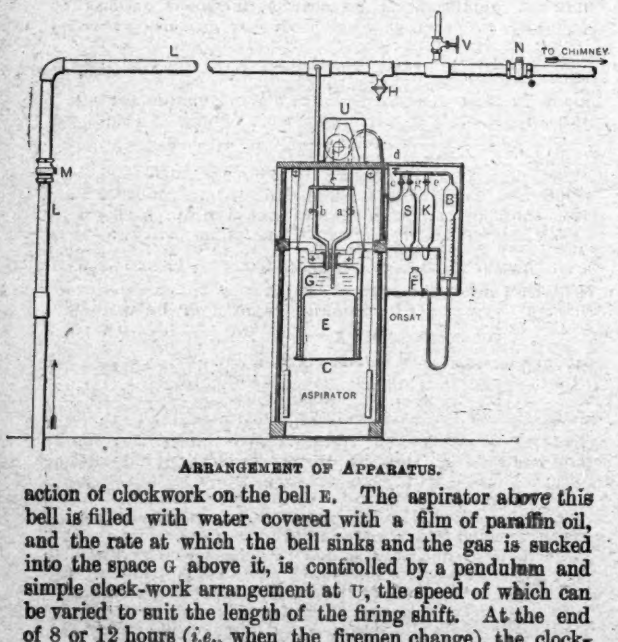
species of the *genus*, it may be a false trade description to apply the name to another *species*. The defendant sold a mixture composed of sulphate of soda and nearly 50 per cent. of crystallised sulphate of soda under the description "soda crystals." Both crystallised carbonate of soda and crystallised sulphate of soda could accurately be called "soda crystals" chemically; but it was proved that in the trade the term "soda crystals" was not applied to crystallised sulphate of soda at all, nor was it usually applied to crystallised carbonate of soda containing more than 2 per cent. of sulphate of soda. It was held, by a majority of the Court, that this was a false trade description. One judge, however, decided that the description "soda crystals," being a true description chemically, could not be a "false trade description within the Merchandise Marks Act, 1887."

A DESCRIPTION OF THE METHODS OF GAS-SAMPLING AND TESTING EMPLOYED BY THE HAMBURG SMOKE ABATEMENT SOCIETY.

By JOHN B. C. KERSHAW.

The engineers of the Hamburg Vereins fur Fenerungsbetrieb und Rauchbekämpfung have adopted a special form of aspirator and testing apparatus for the control of boiler and furnace firing, in preference to the more generally employed automatic CO_2 recording apparatus, for the following reasons :—(1) Automatic recording apparatus is often complicated in construction and easily gets out of order; (2) the percentage of CO_2 alone is not sufficient to enable the engineer to judge of the completeness of the combustion, or of the absence of unburnt hydro-carbon gases and of carbon monoxide.

The sampling and testing apparatus in use at Hamburg has been thoroughly tested, and is now installed on nearly 400 of the boilers under the control of the Society, with most excellent results. The apparatus is shown in diagrammatic form in fig. 1. The sample of gas is drawn constantly (using natural or artificial draught) from the exit flues by means of the pipe L, and as it passes over the aspirator C, a small portion of the gas-flow is sucked down into this by the



Arrangement of Apparatus.

action of clockwork on the bell E. The aspirator above this bell is filled with water covered with a film of paraffin oil, and the rate at which the bell sinks and the gas is sucked into the space G above it, is controlled by a pendulum and simple clock-work arrangement at U, the speed of which can be varied to suit the length of the firing shift. At the end of 8 or 12 hours (*i.e.*, when the firemen change), the clock-work is stopped, and the average sample of gas stored in the space G is tested for carbon dioxide and for oxygen, by aid of the Orsat apparatus shown on the right-hand side of the aspirator, a rubber tube being employed to connect the aspirator and Orsat apparatus.

Two tests of the average sample of gas are made, and the aspirator is then emptied by raising the bell E, and by opening the taps *a*, *c* and *d*.

By closing *a* and opening *b*, and by starting the pendulum of the clock again, the apparatus is set for taking the next average sample—no attention being required for 8 or 12 hours—according to the length of the firing shift.

The pipe L is kept free from soot and rust deposits by blowing steam or compressed air through it (at regular intervals) by means of the tap at V; and snap samples of the exit gas can be taken when desired without stopping the aspirator, by connecting the cock at H with the tap on the Orsat apparatus at *d* by means of a thick rubber tube.

The absorbing solutions used in the Orsat apparatus are caustic potash for the CO_2, and an alkaline solution of pyrogallic acid for the oxygen. These solutions require renewal every three or four weeks.

The percentage of unburned hydro-carbons and of carbon monoxide in the exit gases is calculated from the total percentage of carbon dioxide and oxygen, the total of these two constituents when perfect combustion has occurred, fluctuating between 19·0 per cent. and 19·5 per cent., according to the kind of coal used.

The following tables show the working of the method in practice, with the basis upon which the bonus for good work and fines for bad work are calculated :—

Date. 1907.	Time.	Shift.	Fireman.	Boiler No.	Average per cent. CO_2.	Average per cent. $CO_2 \times 0.$
June 22...	6½ a.m. to 5½ p.m.	Day	Muller	1 and 2	11·3	19·4
June 22-23	6 p.m. to 6½ a.m.	Night	Lange	2	11·0	19·5

Bonus Table for Good Percentages of CO_2.

Fuel burnt, about 7,000 kg. in 12 hours at M. 16 per 1,000 kg. Temperature of the exit gases, 290°—320° C.

Average percentage CO_2.	Fuel saved, in kg.	Value of fuel saved, in Mark.	Bonus addition to wages, in Mark.
8·0	—	—	—
8·5	165	2·60	·15
9·0	360	5·75	·30
9·5	490	7·85	·40
10·0	645	10·30	·50
10·5	740	11·85	·60
11·0	900	14·45	·70
11·5	1,005	16·20	·80
12·0	1,120	17·95	·90
13·0	1,260	20·20	1·00

Fines Table for Incomplete Combustion.

Average percentage of CO_2 and oxygen.	Fuel burnt unnecessarily in kg.	Value of fuel wasted, in Mark.	Fine, in Mark.
19·4	—	—	—
19·0	80	1·25	·10
18·7	225	3·10	·15
18·4	315	5·00	·25
18·1	460	7·35	·35
17·8	610	9·75	·50

Similar tables can be worked out for each boiler installation, taking into account the class of fuel and the amount used per shift.

With the aid of these tables the labour involved in calculating the bonus or fines for each stoker's work is reduced to a minimum, and the men are given a very real incentive to saving fuel and preventing waste.

Freight on Glass Shades for South Africa.—We learn from Mr. F. B. O. Hawes, the secretary, that the National Electrical Manufacturers' Association has obtained a concession from the South African Steamship Conference regarding the freight of electric light glass shades. Hitherto these have been rated in the first-class rate, while gas-lamp shades were carried at the second-class rate (a lower figure). The matter was taken up with the conference by this Association, and the South African lines in the conference have agreed that, in future, common glass shades for electric lights, packed in cases, shall be carried at the second-class rate.

THE LEA AUTOMATIC WATER RECORDER.

According to an article in *Power*, the Lea recorder should be a most useful instrument in the investigation of steam engine behaviour. We gave a brief description of the instrument in our issue of October 23rd, 1908.

As is known, this instrument measures the output of water from a steam engine condenser. The water is collected in a steady tank whence it flows into a notch tank and escapes over a V notch of 90°, 45°, 22½° or other equal division of 90°. The height over the apex of the notch is measured by a float in a tank connected to the notch tank by a pipe of suitable size, which serves to prevent rippling yet is big enough to give prompt levelling. The peculiar feature of the machine is that the movement of the float is transferred to the pen of the recorder by means of a spiral groove on a drum that is rotated by a toothed rack attached to the above float stem. The spiral groove has an increasing spiral pitch from zero, so as to give a pen motion on the formula $H^2\sqrt{H}$, where H is the height of the water service above the apex of the V notch. Where H is measured in inches and F is the flow in cubic feet per minute, the amount of $F = 0{\cdot}305\ H^2\sqrt{H}$. With such a spiral, therefore, the pen movement is proportional to the volume of water flowing, and practically to the weight of flow, since the float sinks deeper in warmer water and corrects automatically for temperature. The V notch has the valuable property that for all values of H the coefficient has the same value and it is proportionate to the angle. Its value 0·305 is for the notch angle of 90°. For small amounts of water the notch may be quite narrow and the flow will be similarly less, the coefficient for 9° being 0·0305, and so on.

If one of these instruments be watched at work, it will be found very promptly to respond to any change that may be made in the *régime* of the engine. Thus, if the hand regulated cut-off for the low-pressure valves be changed to a less economical point, the water consumption will increase, and the increase will begin to be recorded in a few seconds after the change of cut-off has been made. A few seconds are, of course, needed for the increased steam to appear as water flowing to the air pump. Very soon, steadiness of action is attained and the flow is recorded steadily at a higher figure. If such a change were made in an engine under ordinary test conditions, a whole day might be given over to the run. To try the effect of half a dozen points of L.P. cut-off would easily extend to a week's run. With a steady load such a series of tests could be made either in a series of steps of, say, 10 minutes' duration each, or by means of an index plate on the shifting wheel of the cut-off gear, it might be arranged that the wheel should be moved so many degrees every 10 seconds, so that the recorder would trace a steady curve from earliest to latest cut-off, and the height of the curve at each minute would coincide with the water consumption of the engine with the cut-off then in action. Similarly, a series of tests could be made for which only the pressure varied, or the temperature of superheat, or the amount of condensing water, or the use of steam in the reheater or jackets, or the load on the engine. What now amounts to elaborate and expensive tests would be rapidly made with an accuracy beyond what would be likely to attend a long test during which so many items might vary.

The recorder proves what has become recognised by engineers—that a steam engine is a very regular machine. Give it a set of standard conditions to work with and it will produce the same indicator card for hours. There is, therefore, no occasion for long tests. A boiler test has to be of some considerable duration, because it is impossible to make an accurate estimate of the fires at any time, and a long run is made in order to reduce to a minimum the relative importance of the terminal inexactitudes, and of the steady running figures. But this is quite absent in an engine test. There is no terminal uncertainty to be taken into consideration. The rate of steam consumption of an engine is always taken when the engine has attained a permanent condition of temperature, and that being attained the rate of steam consumption is simply read off the recorder diagram.

The experimental conditions are then varied a step, a few minutes allowed for the cylinder to change its mean temperature and readings taken every minute then until no change occurs. A whole curve of results can be plotted out in a few hours, and accurate estimates of the effect of varying conditions found. It is pointed out that the best and most rapid and accurate results can be obtained where each engine possesses its own condensing plant.

Condensers common to two or more engines can be suitably recorded, but a variation made upon one engine is liable to be more or less vitiated by any change in the other engines. And the change in the steam used by one engine will bear a more insignificant ratio to the total than where only one engine is dealt with.

Jet condenser engines can be similarly dealt with, but the records of steam used can only be calculated by the aid of temperatures in apportioning the total flow between the injection water and the working steam. There may be cases where the injection water can also be measured before use, as well as after, the difference then counting as steam condensed. The instrument seems to bring a step nearer the complete automatic measurement of everything about a station.

New Arc Lamp.—Messrs. Veritys, Ltd., inform us that they are placing on the market for this lighting season a new arc lamp of exceedingly simple construction. This lamp is listed for 3-4 amperes and 5 amperes; it burns for 60 hours, and is of their own make.

BUSINESS NOTES.

Consular Notes.—France.—The British Consul at Lyons reports that the products of the French metal industry find it increasingly difficult year by year to keep a footing in foreign markets—much more to find new outlets abroad, and those best qualified to judge urge the Lyons manufacturer to concentrate all his efforts upon the development of the home market, and the supplanting of the foreigner, more especially the German, who is leaving no stone unturned to capture the French trade. Lyons and its district are noted for the construction of steam engines of all kinds, petrol and gas engines, and small locomotives for narrow-gauge railways, while the important locomotive works of the Paris-Lyons-Mediterranean Railway Co. at Oullins have a complete plant for repairing large railway engines. The output of the Lyons boiler-making industry, though hard pressed by foreign competition, also runs into large figures yearly. Rolling stock, metal girder work and cables are also flourishing branches of the trade. With regard to the last-mentioned industry—very important by reason of the enormous development of hydro-electricity within recent years—it seems to be only a matter of time before aluminium takes the place of copper for cables, thus finding a fresh use for its large output in the water-power works in the Alps. The copper and aluminium industry is very flourishing. The electro-metallurgical industry suffered throughout 1908 from the effects of the general crisis, the most serious symptom being a heavy fall in prices, particularly in the case of aluminium, where a decline of 50 per cent. in the market rates was registered. The official statistics for 1908 of the output of the chief products of the electric furnace (special iron alloys and aluminium) which had made great strides during the three previous years, are not yet available, but the export figures seem to indicate that production received a check (see below.) It is said, indeed, that the crisis in this industry was aggravated by over-production, especially of aluminium, during the period 1905-7, further contributing to the fall in prices.

Production and Exportation of Electro-Metallurgical Products During the Years, 1906-8.

	1906.	1907.	1908.
Special alloys of Iron—			
Production ...	13,700,000 kg.	15,700,000 kg.	—
Exportation ...	7,758,000 kg.	8,149,000 kg.	9,585,000 kg.
Aluminium—			
Production ...	3,396,000 kg.	4,686,000 kg.	—
Exportation ...	1,473,000 kg.	1,118,000 kg.	1,331,000 kg.

The most important branch of the electro-chemical industry consists in the manufacture of nitrates. Cynamide is now being regularly produced by works at Notre Dame de Briançon (Savoy), and important new works which the Nitrogene Co. is building will begin to turn out nitric acid and nitrate of lime in the course of the present year (1909).

The development of water-power grows apace in the valleys of the Dauphiné and Savoy, and every year sees fresh falls laid under contribution and harnessed in the service of industry, thereby adding many thousands to the already large total horse-power now developed by white coal in the mountainous districts of south-eastern France, and involving the erection of new works, either for the manufacture on the spot of various metallurgical and chemical products, or for the generation of electric power for transmission over many scores of miles for traction and industrial purposes generally. In the Grenoble district alone, seven new companies for exploiting the hydraulic forces of the Dauphiné Valley were formed in 1908 with an aggregate share capital of over 10,000,000 fr. (£400,000), of which six were for generating and distributing electrical energy for a variety of industrial purposes, including the lighting of the town of Grenoble, and the remaining one for driving paper mills at Voiron—the waters put into harness for these enterprises being those of the Drac, a tributary of the Isere, its affluents the Champa and Gresse, the Odole, a small affluent of the Romanche and the Lake of Aiguebelette, in the Chambéry district. Though by no means the most important industrially of these new companies, the Lignes Electriques is perhaps, the most interesting, as showing the great distances over which electric power is now commonly sent by overhead wires; for the object of this enterprise is to construct a line for the transmission of power from the power station in the Grenoble Alps to Gier, in the Loire coal basin, with eventual extension into Central France.

As an outcome of the isolation of Paris from the rest of France during the post office strike in the spring of the present year, experimental wireless telegraph stations were temporarily established on the heights commanding Lyons and Grenoble, thus connecting those military centres with each other and with the Eiffel Tower station in Paris. The Consul understands that similar installations have been made at Toulon.

Catalogues and Lists.—The General Electric Co., Ltd., 71, Queen Victoria Street, London, E.C.—New list (No. F1,350) of 24 pages, relating to an interesting variety of electric advertising signs, also a number of shop lighting fittings, including lanterns and reflectors. The Osram lamp has led to the addition of quite a new department to the shop-fittings branch, and some very effective designs are introduced to meet the demand occasioned by the prevailing popularity of Osram lighting fittings among shopkeepers. Reflector fittings for direct and in

verted lighting, cluster lights, automatic time switches, electric flashers for signs and advertising devices, "Striplite," also the "Pixielite" strip for decorations and temporary lighting, are well shown. Those who are interested in this increasingly important department of electricity supply business should write to the company for a copy of this "Signs of the Times" list.

Messrs. Thomas L. Scott & Co., Ltd., 28, Martin's Lane, Cannon Street, E.C.—Leaflet briefly describing Scott's patent flexible trolley wire suspension.

The Crypto Electrical Co., 155 and 157, Bermondsey Street, London, S.E.—Leaflet illustrating, describing and giving prices of their single, two and three-phase A.C. motors of ½ to 20 H.P., which, owing to extension of their works, they have been able to put through in larger quantities and at reduced prices.

The Patent File and Tool Co., Ltd., 8, White Street, Moorfields, E.C.—Leaflet describing their "Dreadnought" milling file; a second pamphlet details their "Smooth on" compound, cement and other specialities.

The Reason Manufacturing Co., Ltd., Brighton.—Eight-page pamphlet containing a detailed description, with clear interior views of the mechanism, of their hand-wound time switches.

Messrs. Parmiter, Hope & Sugden, Hulme Electrical Works, Ellesmere Street, Hulme, Manchester.—Eight-page "Progress Sheet" (No. 4), in which are described the "Ajax" 1910 pattern K-type ironclad switches, Lyon ironclad switch and fuse, Hope's "N" type fuse, new "M" pattern ironclad fuseboards, "Ajax" ironclad power boards and motor panels. Prices are tabulated.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 224 (12 pages) containing a full description, illustrated and set out in the B.T.-H. well-known standard form, of the firm's enclosed oil switches. Dimensional drawings and diagrams, also tabulated prices, are given. The switches are specially designed to provide a totally-enclosed oil switch which can be fitted with any of the usual automatic accessories, and which can be operated with perfect safety by unskilled workmen. They are claimed to be capable of meeting the most severe requirements on systems up to 3,000 volts.

The Kul Bearing Co., 1, Mill Lane, Blackburn.—Leaflet and sample tin of Kul, a greyish powder which, it is claimed, when poured into the usual lubricating devices of a bearing that is running hot, will prevent any stoppage due to hot bearings and ensure continuous running until time allows of their overhaul.

The National Electric Signs Co, Ltd, 112, Bath Street, Glasgow.—Brochure describing the Universal electric sign, which exhibits phases containing over 40 illuminated letters or numerals, and conveying any announcement within its scope; a continual succession of such announcements is automatically shown, thus adding endless variety to the other excellencies of the electric sign as an advertising medium.

Messrs. Geo. M'Cartney & Co., Burnside Works, Cumnock, N.B.—Postal card drawing attention to switchgear manufactures, of which they make a speciality.

The Abbey Electric Co., 17, Victoria Street, London S.W.—Four-page list giving illustrations (interior and exterior) together with full particulars of prices of their improved pattern "Abbey" flame arc lamp. The firm have appointed Mr. J. W. Beswick, Temple Chambers, 33, Brazennose Street, Manchester, as their representative in Manchester and district.

The American Metal Hose Co., 173, Lafayette Street, New York City.—Price leaflet of flexible arms for portable electric lamps.

Mr. G. Braulik 8, Lambeth Hill, E.C.—Small leaflet relating to his "Eclipse" metallic-filament lamps stating their good points and prices.

Mawdsley's Contracts.—The following is a list of contracts that Messrs. Mawdsley's, Ltd., of Dursley, either have now in hand, or have recently completed:—

Nine motors aggregating 510 H.P., for equipment of granite quarry.
Fourteen motors aggregating 420 H.P., for new rubber factory in Manchester.
Booster sets, for Agent-General for the Cape, and for the Crown Agents for the Colonies.
Variable speed motor for coupling to Reavell compressor.
Dynamos and boosters, for new generating stations at Tewkesbury and Chippenham.
Hydro-electric installation, comprising turbine dynamo and motors, for sugar factory in Mauritius; and in addition a large number of lift and other motors.

Employment Register.—Some time ago an Employment Register was instituted by the Society of Engineers for the use of professional engineers seeking employment. The principal features of the register are as follows:—

1. No fees of any kind are charged, the cost of management being defrayed by the Society.

2. Qualified engineers of all grades may have their names recorded, though in making a selection from a number of equally suitable men preference is naturally given to members of the Society, for whom the register was originally instituted.

3. Only a few names of probably suitable candidates are put forward for each vacancy, so as to facilitate the employer's choice as much as possible.

4. Every effort is made to get personal knowledge of candidates, together with full details of their qualifications, before sending in their names.

We are informed that a number of well-qualified men, representing the various branches of engineering work, are now available, and it is thought that if the register were better known it would be widely used and appreciated by all who require draughtsmen, inspectors, and other classes of assistants. Employers are invited to send inquiries by telephone or in writing to the secretary, Mr. A. S. E. Ackermann, 17, Victoria Street, S.W., stating their requirements as regards age, qualifications, salary, &c.

Venner Time Switches.—Among recent orders booked by Messrs. Venner & Co. are the following: 100 time switches for Bedford, and 48 for Cork, both of these following on several previous orders; also an order from the North Metropolitan Electric Supply Co. for time switches for controlling the street lighting at Hertford.

Trade Announcements.—Mr. H. C. Barlow has resigned his position as representative of the Electrical Co., Ltd., Manchester Branch, and commenced business as H. C. Barlow and Co., at 52, Chapel Street, Salford, Manchester, where he will make a speciality of switchgear, electrical accessories, metallic-filament and carbon lamps, cables and flexibles, flame arc lamps, &c.

Messrs. Mawdsley's Ltd., of Dursley, have appointed Mr. S. Mansel Jones, of Western Mail Chambers, Cardiff, and Wind Street, Swansea, as their sole agent in South Wales for the sale of Mawdsley Zone patent dynamos and motors.

For Sale.—On November 3rd and 4th Messrs. B. Norman & Son will offer for sale by auction, at 73, Golden Lane, E.C., a variety of plant and fittings, including electric motors, apparatus, telephone and electric light fittings, in *re* D. Bernstein and Co. (deed of assignment). Particulars appear in an advertisement to-day.

Book Notices.—*Drawings for medium-sized Repetition Work.* By R. D. Spinney, A.M.I.M.E. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.—The large amount of repetition work which now obtains in manufacturing engineering is due to a general recognition of the advantages of standardisation. Motor-car work, with which the author deals exclusively, has instanced this perhaps more strikingly than any other industry. It is now fully recognised that not only is it cheaper to produce details in large quantities because of the reduction in the "share" cost of specials tools, jigs, &c., but also that standardisation assists manufacture for stock and considerably reduces the idle periods of all machine tools. The responsibility of the draughtsman has consequently been increased, for the slightest waste on a poorly-designed detail may represent a considerable financial loss when multiplied by the number of such details produced. The author in this small volume deals with the drawings for repetition work, the word "drawings," as the author defines it, covering the visible result of the draughtman's labours, and including the fullest necessary instructions for the buying and making of the component parts of machines. He takes the one reasonable view of the drawing—that it is only justified as it contributes to the efficient manufacture of machines, and is not something to be coloured and indexed *ad infinitum*. The first three chapters are devoted to "system." The method of preparing shop drawings and lists is treated in detail. The fourth chapter, headed "Tolerances," deals with the methods of measurement in workshops, the necessary difference of size for various classes of "fit" and the allowable variations from nominal dimensions. The method of marking dimensions on drawings must ensure that time is not wasted in obtaining unnecessary accuracy, and also that the tolerances do not add up producing trouble in assembling. A very suggestive chapter on designing is perhaps one of the best, and the author gives several examples showing how the amount of work on a detail can be reduced by a little forethought. A short chapter on office routine brings the work to a close. The book is well produced, and worth the money expended by the draughtsman who wishes to understand his work.

British Standard Specification for Keys and Keyways. (*Report No.* 46). London: Crosby Lockwood. Price 2s. 6d. net.—The report is divided into two sections, the first being a specification for the steel bars from which the keys are to be cut, and the second dealing with the proportions of keys and keyways recommended. The specification requires a minimum tensile breaking strength of 36 tons per sq. in., with an elongation of 12 per cent. on the test piece specified. A list of standard sizes is given, and the margins of manufacture to be allowed on merchant bar are defined. With regard to the second section of the report, the information which the Committee obtained from engine builders and others has been supplemented by the results of their own experimental work, and the standard sections for sunk keys given are based on data obtained from these two sources. At present only sunk keys (taper and parallel) are dealt with. Recommendations as to tolerances on the finished key and keyway are included. The experimental work was done by Mr. P. A. Ransom.

The Patent Road to Fortune. By a Successful Traveller on it. Hull: Burtt Brothers. Price 3d. net.—Many have said, as the outcome of bitter experience, that the "Patent Road" leads to the workhouse; this little book, while it does not profess to teach invention, tells how to patent an invention, how to set about working or selling it, and a vast number of other matters of interest to those who wish to get rich by this pathway. It is clearly and pleasantly written, and covers in brief the whole field of patent law and procedure; apart from the title, it does not paint too rosy a picture. It includes sections on trade marks and copyright.

University of London, University College, Calendar, 1909-10. London: Taylor & Francis, 1909.—This bulky volume of some 680 pages testifies, by its bulk alone, to the rapidly-growing importance and activity of the reconstituted University of London. The Calendar, of course, deals with University College in particular, but this being the original foundation, and the principal constituent of the University, may be regarded as the body, with the associated teaching institutions as members. Full details are given in the Calendar of all the departments and staff, the various curricula, examination papers (occupying 200 pages), lists of graduates and students of the College, scholarship regulations, &c. Dr. J. A. Fleming is Pender Professor of Electrical Engineering,

with Prof. W. C. Clinton as assistant; Mr. H. M. Hobart is Lecturer on Electrical Design, and Mr. G. B. Dyke demonstrator. We have previously drawn attention also to the post-graduate courses in engineering, which will be conducted by specialists of the highest standing. Courses on Railway Engineering and Surveying have already commenced, and Mr. Hobart's course on Electrical Design begins on the 27th inst.

"Differential and Integral Calculus." By A. E. H. Love. London: Cambridge University Press. 1909. Price 5s.

"Cape Colony To-Day." Second edition. Issued by the Cape Government Railway Department.

"Prospectus of the Royal College of Art, London." Wyman and Sons. Price 3d.

A new monthly review dealing with municipal government matters is to appear shortly, under the title *The Local Government Review*.

"Voltage Ratio in Synchronous Converters," and "Electromotive-Force Wave-Shape in Alternators," by Comfort A. Adams; and "Pole-face Losses," by C. A. Adams, A. C. Lanier, C. C. Pope and C. C. Schooley. Reprints from the *Proceedings* of the American Institute of Electrical Engineers.

Bankruptcy Proceedings.—H. P. ALLISON.—An application for an order of discharge was made on Wednesday last week, to Mr. Registrar Giffard, at the London Bankruptcy Court, on behalf of Harry Pigott Allison, who traded in partnership with Joseph Grace Smith Cunnington, at 7, Great Newport Street, St. Martin's Lane, W.C., under the style of Laing, Wharton and Cunnington. Mr. E. Leadam Hough, Senior Official Receiver, reported that the firm failed last May with provable debts £6,923, and assets which had realised, or were likely to realise, £2,495. The offences reported by the Official Receiver were: (1) insufficiency of assets to pay 10s. in the £ to the creditors; and (2) trading with knowledge of insolvency. Mr. Hansell appeared in support of the application, and asked for the discharge to be granted, subject to his client consenting to judgment of £200. He submitted that it was a very unfortunate case for the applicant, who for some years was engaged as chief electrical engineer to a firm in India. Owing to ill-health, he had to throw up that engagement, and return to England. He entered into partnership with Mr. Cunnington, and they were persuaded to buy the business of the Improved Electric Supplies, Ltd., which proved to be a bad bargain, and brought about their failure. His Honour agreed with the learned counsel's view of the case, and granted an order in the terms suggested.

ERIC EATON, electrical engineer, Alexandra Road, Ashton-under-Lyne.—A receiving order was made on October 14th on debtor's own petition.

Dissolutions and Liquidations.—THE X ELECTRIC ACCUMULATOR CO., LTD.—A meeting of creditors has been called for October 27th to consider a proposal for finally winding up, as there is no hope of ever realising anything. It is now nearly 12 months since the company went into voluntary liquidation, and the sole asset which remained was an interest of 10 per cent. on the net profits of the X Syndicate, Ltd., a company formed for the purpose of purchasing from the debenture-holder's Receiver the entire property of this company. The X Syndicate, however, has been similarly unsuccessful, and some weeks ago the debenture-holder took possession, and the plant and machinery were sold by auction. Since then an application has been made to the Court for a compulsory winding-up order. Under these circumstances, after consultation with some of the large creditors, a meeting had been called as above.

LA CAPITAL (EXTENSIONS) TRAMWAYS CO., LTD.—This company is winding up voluntarily, with Messrs. E. A. Lazarus and F. Thursby as liquidators.

IMPROVED ELECTRIC GLOW LAMP CO., LTD.—A meeting is to be held at Salisbury House, E.C., on November 22nd, to hear an account of the winding up from the liquidator, Mr. F. F. Fuller.

CUTLER, WARDLE & CO., LTD., electrical engineers, Manchester.—Mr. A. G. Mellors, in reporting upon the now completed realisation of this estate, regrets that no surplus is available for the unsecured creditors; indeed, there is not sufficient to pay off the debentures. The summary shows receipts amounting to £1,439 from the sale of stock-in-trade, machinery, patent rights and factory, also collection of book debts. After settling business expenses, preferential creditors for rents, receiver's remuneration, payment of first debenture and interest (£518), and a first and final dividend of 14s. 2d. in the £ on further debenture claim and interest (£378), there is a balance remaining of only £1 17s. 1d.

The Lighting of Blackpool Aviation Grounds.—THE BRITISH WESTINGHOUSE CO. are lighting the Aviation Grounds at Blackpool with 36 of their "Arcturus" flame arc lamps. These have outdoor choking coils for running the lamps four in series on a 200-volt 83-period circuit.

LIGHTING and POWER NOTES.

Amble.—The local Council, which is considering the desirability of adopting electricity as a mode of lighting, has appointed Mr. Cecile A. Esmarch, M.I.M.E., of Newcastle, to advise the Council on a lighting scheme for the town and to report.

Aspull.—The U.D.C. has sealed the transfer of the prov. order to the Lancashire Electric Power Co., who will pay £308 as consideration.

Blackpool.—The returns from the electricity department for September show a decrease on the total works output, as compared with the corresponding period last year, by 11,303 units; private lighting showed a decrease of 11,002. For the half-year ended September the output has decreased in private lighting by 24,604; public lighting increase, 6,289.

Bahamas.—Electric light has just been installed by the Bahamas Government at Nassau, the total estimated cost being £15,500 for a system of direct current and large cables. The generators are driven by suction gas engines. It will probably be necessary to expend another £1,000 on a storage battery to provide for a day supply for industrial purposes and for an all-night service.

Barnes.—Application is to be made to the Local Government Board to sanction a loan of £4,100 for mains and £3,000 for house services. The electrical engineer reported at the last meeting of the Council that extensions of mains estimated to cost £500 would be required to supply a number of houses. The engineer mentioned that it was now the exception in the district for a builder to put in gas pipes for lighting. To enable local wiring contractors to advertise electric heating and cooking apparatus they are to be charged in future at the flat rate of 1½d. per unit, provided their displays of fittings are satisfactory.

Bootle.—The T.C. has decided to extend the mains at a cost of £1,070 to supply the works of Messrs. Williams, Harvey and Co., Ltd., and other consumers in the neighbourhood.

Braunton (Devon).—The P.C. has definitely decided to support the electric light scheme submitted by Messrs. Crompton and Co., Ltd. The company offer to take about £400 of the necessary capital (£3,500) to be raised, and for public lighting energy will be supplied at 8s. per annum per 50 C.P. lamp.

Brighton.—The Aldrington electric lighting, upon which some £9,000 has been spent, resulted in a loss of £452.

Canada.—The Aylmer (Ont.) municipal electric light works was completely wrecked by a boiler explosion, and an engineer was killed, last week. An adjacent factory and buildings were destroyed by fire, and many buildings were damaged. The damage is estimated at £40,000.

Chadderton.—The U.D.C. has consented to the application of Oldham T.C. to supply electricity to consumers in the Chadderton district.

Continental Notes.—FRANCE.—La Société de Distribution d'Energie Electrique du Rhone is the name of a new company which has just been formed in Lyons, with a capital of £60,000.

BELGIUM.—The Compagnie Continentale du Gaz is establishing a large new central electric lighting station at Droogenbosch; the contract for the generating plant for the same, as well as for the mains, has been placed with the Société Union Electrique A.E.G., of Brussels. The contract comprises a 2,000-H.P. steam turbine and alternator, and a similar set of 1,000 H.P.

ITALY.—According to the *Gas World*, Messina, after having been in darkness for many months since the earthquake there, has had a service of electric lighting restored, "which is said to show up the rows of wooden houses very well."

Dundee.—The competition between the electricity and gas departments came in for criticism at a meeting of the T.C. For the better lighting of Lochee the sub-Committee accepted a tender by the electrical engineer of 16 flame-arc lamps of 54,000 C.P. at an annual cost of £144, against a tender by the gas manager to supply 31 lamps of 11,000 C.P. at an annual cost of £156. Replying to criticism, Mr. Richardson, the electrical engineer, said he was driven to competition; if ever he got anything he had to fight hard for it against gas. The recommendation in favour of electricity was adopted.

Evesham.—The T.C. has deferred full consideration of the proposed application for a prov. order for E.L. by the Stratford-on-Avon Electricity Co., Ltd., pending the receipt of more definite information as to the wishes of the ratepayers.

Fife.—The electric power station at the Rosyth naval base is being pushed forward, but pending its completion it has been decided to put down a temporary plant; 16 electric cranes, supplied by a Leeds firm at a cost of £10,000, will soon be at work.

Glasgow.—The T.C. is making strenuous efforts to eradicate the smoke nuisance in Glasgow, and firms are asked in their own interests to introduce the latest stoking appliances. This week it was reported that the North British Locomotive Co. had recently installed 20 motors (with an average of 35 H.P. each), obtaining power from the Corporation Electricity Department.

Hull.—A stand is being made by users of electricity for lighting purposes for the same discount which is granted users of current for power. The Hull Chamber of Trades has forwarded a pointed communication to the Electric Light Committee, urging this point. Mr. Bell, the electrical engineer, stated in reply to questions, that the reason why discounts were allowed off motive power accounts and not off lighting accounts, was that the latter are rendered quarterly, while motive power accounts are rendered monthly. It would not be feasible to render lighting accounts monthly. Councillor Costello urged that users of light to the value of over £20 per annum should be allowed a discount if they made payment within 14 days. Eventually the matter was referred to a sub-Committee, to be considered in connection with the estimates.

Grassington (Yorks.).—The electric lighting installation in the village was inaugurated on the 15th inst. Energy is generated by a small plant erected on the river, and using water power. The official opening ceremony is to take place in a few days' time.

India.—It is understood that the Oudh and Rohilkhand State Railway is arranging to fit Stone's system of electric lights and fans to four first class, four composite first and second class, and four second class carriages.—*Indian Engineering.*

Llansamlet.—A scheme of electric lighting is being promoted for the Glais district by Mr. Evan Lewis, of Graig-y-pal.

London.—Marylebone.—Hot water is to be supplied to the lavatories in the Town Hall by means of small Therol electrical heaters. The cost of supplying and fixing the apparatus will be £45, and the annual cost for energy, which will be supplied at 1d. per unit, will be about £10.

Stepney.—The Blyth's Wharf generating station is to be opened by the Mayor on the 27th inst., when any machinery that may be ready for use will be set in motion by the Mayoress. Application is to be made to the L.C.C. for a loan of £10,250 for mains extensions.

The L.C.C. is to submit to the B. of T. proposed agreements between the London Electric Supply Co. and Westminster, and St. James' and Pall Mall Companies, for it to determine whether these fall within Sec. 3, London Electric Supply Act, 1908; also a copy of the Highways Committee's report on the above, and on an agreement between the South Metropolitan Co. and West Kent Co. If the B. of T. approves the agreements, the Council suggests certain amendments, mainly with a view to safeguarding its purchasing powers.

East London Electrical Exhibition.—On Tuesday afternoon last the joint Electrical Exhibition, promoted by the Shoreditch, Hackney and Stepney Borough Councils, was opened by Mr. W. M. Mordey, in the Pitfield Street Baths, Shoreditch, a large gathering of the civic representatives of the three boroughs being present. Amongst the prominent exhibitors mention may be made of Messrs. Siemens Bros. & Co., who make a feature of their O.S. wiring system, tantalum lamps and fittings, cables, cells, batteries, &c., and in the Machinery Hall have a stand devoted to switchboard and testing instruments of the latest type. An interesting little appliance on one of their stands is a portable motor-driven vacuum pump, of compact arrangement and mounted on wheels—a device which in some form or other deserves more attention than it has hitherto received. Messrs. Simplex Conduits, Ltd., exhibit their conduit specialities, heating and cooking appliances, and metal-filament lamps, and Messrs. Marryat & Place show a miscellaneous collection of electric plant, including an interesting example of the Moissan electric furnace. Street lighting specialities figure on the stands of Mr. Haydn T. Harrison and the Reason Manufacturing Co., which latter firm is also showing electrolytic meters, demand indicators, &c. Mr. Harrison also watches over the interests of the Thorpe Meter Syndicate, who show their recently introduced electrolytic wattmeters, time-lag circuit-breakers and motor starters. Messrs. Worssam & Son have an attractive motor-driven refrigerating plant suitable for country house installation, while Messrs. Ferranti, Rashleigh Phipps & Co.—who exhibit electric signs—Pooley & Austin, Tyler & Freeman, and many others are responsible for interesting exhibits.

Norwich.—The T.C. has been recommended, at the termination of the existing contract with the Gas Co., to convert the gas lamps in the city to electric ones.

Port Glasgow.—The question of introducing electricity has been discussed by the T.C. at various times during recent years, but the members have not been unanimous as to the course to be followed and nothing definite has been done. A few of the councillors are of opinion that plant should be laid down at the refuse destructor works, while others hold that the better plan would be to obtain a supply from Greenock. Some months ago a petition was presented to the Council by the shipbuilders and other large employers of labour in the town asking that the Council should endeavour to come to terms with Greenock. Negotiations were carried on between the two burghs for some time, but latterly the matter was allowed to drop. Last week the Messrs. Lithgow, who are reconstructing the Bay area, reopened the subject in connection with the lighting of the shops in the new area, and the T.C., at a meeting in committee, agreed to approach the Greenock Corporation with a view to obtaining a supply of electricity from that burgh.

Ravensthorpe.—The U.D.C. has given consent for the Yorkshire Electric Power Co. to use overhead lines to the Mirfield boundary for supplying energy to Brighouse.

Rhyl.—At a meeting of the D.C. held last week, it was announced that an offer had been made for some of the old plant at the electric light works, which will be superseded by the new oil engine. The clerk was instructed to ask the sanction of the L.G.B. to the sale.

Rochdale.—The T.C. has approved of an agreement to supply electricity in bulk to Littleborough U.D.C.

South Africa.—Potchefstroom.—The T.C. has held a special meeting to consider several important matters, including a municipal electric lighting scheme, which is estimated to cost £15,000, and the consideration of which has been provisionally sanctioned by the Government.

Southampton.—At the last meeting of the T.C., it was agreed that Parliamentary powers be sought to carry on the work of "free or assisted wiring, to install wires, fittings, &c., through a contractor, but not otherwise, and to hire out arc lamps, heating apparatus, and cookers either at a rental or on the deferred payment system." On the motion for the adoption of the recommendation, Mr. Hirst moved as an amendment that the whole question of the financial position of the electricity department be referred to the borough treasurer for report, and in the meantime the matter of free or assisted wiring be adjourned. The amendment was, however, lost. It was further decided to obtain Parliamentary powers for the reconstruction of certain tramways and the acquisition of certain properties.

Stafford.—The T.C. has fixed the following scale of discounts for consumers of over 3,000 units per quarter:—From 3,000 to 4,000, 15 per cent.; from 4,000 to 5,000, 17½ per cent.; over 5,000, 20 per cent.

Surbiton.—The U.D.C. has received from the L.G.B. sanction to a loan of £1,266 for the extension of the electricity works.

Swansea.—The B. of G. has asked the borough electrical engineer to prepare a scheme for lighting Blocks 1, 2 and 3 of the workhouse.

Widnes.—With the object of showing the B. of T. that it is in earnest, the T.C. has decided to have plans and estimates prepared for an electrical station at an estimated cost of £4,100. The E.L. order was obtained four years ago, and the Council is negotiating with a company connected with the Salt Union, which offers to supply current to the town.

Worsley.—The U.D.C. has sealed the transfer of the E.L. order to the Lancashire Electric Power Co.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The question of the price of the electrical energy supplied to the Suburban Tramway Co., came up for discussion recently. The secretary of the Tramway Co. contended that, instead of complying with the terms of the agreement and the reference to him, and fixing a price for every unit actually supplied, the arbiter had ordained the company to pay a standing charge of £900 per annum, irrespective of the number of units that may be actually supplied. Mr. Kemp moved that intimation be made to the company that, so far as the Council was concerned, the decree arbitral was accepted as final and binding, and that a remit be made to the Committee to give effect to this resolution. A long discussion ensued. The amendment was adopted by 16 to 13 votes.

Australia.—The South Australian Government has recently obtained a report from Mr. W. G. T. Goodman, chief engineer of the Adelaide Tramways Trust on the electrification of the Glenelg suburban railway line, which he estimates would cost £201,760. The city terminus of the line is in King William Street, along which the steam trains operate at present; they also operate in the main street at Glenelg, and in both these instances it is pointed out that electric working would be much preferable to steam. Mr. Goodman proposes certain alterations in the routes with a view to giving a double track throughout; the length of route considered amounts to 7 miles 28 ch. He further recommends that the Tramways Trust should have running powers over the King William Street lines, with a view to avoiding the placing of four tracks in that thoroughfare, and that the gauge should be altered to the standard. Mr. Goodman foretells a better, safer and speedier service, greater convenience at termini, and a satisfactory financial result. The system would operate with the overhead trolley.

Blackpool.—A net increase of £1,496 has been taken in receipts on the cars during the season from April 1st to October 7th. The total receipts were £42,536, compared with £41,040 in the corresponding half-year of 1908. There had been an increase of 182,515 in the number of passengers.

Bournemouth.—The annual church parade of the Corporation Tramways employés took place on Sunday. As a matter of fact, a good proportion of the men did not take part in the actual parade to church, at least three contingents of about thirty on each occasion being taken in the Corporation motor-'bus, a singular commentary on the Sunday traffic decision at the Council meeting in the previous week.

Brazil.—In connection with the frequent opening of new tramway services by the Rio de Janeiro Tramway, Light and Power Co., the *Brazilian Review* says: "Now that the service all over the zone is being improved every day, the scoffers of some months back have turned their scoffings to blessings, and readily admit that not only is the amount of work done almost incredible, but that the service is gradually approaching that perfection which the company has set up as its ideal.

Continental Notes.—Germany.—A fresh dispute has arisen between the Grand Berlin Tramway Co. and the city of Berlin as a result of the former's claim to have received from the magistrate the exclusive monopoly for the working of tramways in general, and in particular of the tramways from the Stellin

Bahnhof to the Central Vichhof and from the Vichhof-Rudolf Virchof to the Kraakenhaus, which have been constructed and are operated by the municipal council. The company contends that these lines have caused it to lose £2,000 during the past year, and that the city is responsible for the loss. According to the working return of these particular tramways for the year, a considerable surplus has been realised, and the company therefore demands the payment by the city of the £2,000 mentioned as compensation, and reserves other claims for the future. In addition, the company notifies that other claims will be presented in connection with the three municipal tramways which it is proposed to construct in the south of the city.

BELGIUM.—La Société des Tramways Bruxellois has applied for a concession for a new line of electric tramway in Brussels between the Gare de Luxemburg and the Place Dailly.

ITALY.—In connection with the Socialist demonstrations, the whole of the tramways and cabs in Rome suspended service on the 14th inst.

AUSTRIA.—It is reported from Vienna that the negotiations in respect of the projected conversion of the city railway to electric traction are expected to be brought to a conclusion during the forthcoming winter. The expenditure on the work is computed at from 40,000,000 to 50,000,000 florins, which would presumably be raised by a city loan, and the transformation would be undertaken by the Laender Bank in conjunction with the Siemens-Schuckert Co. The conversion represents one of the fondest wishes of the mayor, and is said to be only possible simultaneously with the municipalisation of the undertaking. At present the railway belongs in equal thirds to the Lower Austrian District, the Austrian State and the City of Vienna, and the management of the line is in the hands of the Austrian State Railway Administration in return for a small payment by the three parties concerned. The mayor hopes that after transformation the railway will yield results as favourable as the electric tramways, but it is declared that the surplus realised by the latter will become a deficit if the demands made by the employés for higher wages, which are not unjustified, are granted. The principal difficulty in regard to the suggested transfer of the railway to the Municipal Council lies in the circumstance that the latter is not inclined to pay anything for taking over the undertaking, whereas the other two co-proprietors are not disposed to agree to the change without compensation. It is possible that the present co-operation of the Laender Bank will bring the negotiations to a fresh stage.

The new Ronstal railway in the south of the Austrian Tyrol was completed and set in operation on October 11th. It is 37 miles in length, and connects Trient, Clep and Malé, and a branch line nearly 15 miles long leads from Dermullo to Fondo-Mendel. The railway is the longest electrically-operated overland line in Austria, and is the first to be constructed by the department of the State Railway Administration for the account of the concessionaires. The maximum rise in the main line is 53 metres per 1,000 metres, the gauge is 1 metre, and the speed amounts to about 12½ miles per hour. Power is supplied by the electricity works of the town of Trient, on the Sarca, and is distributed to the line from three transformer stations. The rolling stock comprises 10 four-axle passenger motor coaches, each capable of accommodating 44 persons, 12 passenger trailer coaches of the same capacity, 12 covered and 15 open goods wagons, each of 7 tons carrying capacity, and 3 mail coaches.

SWITZERLAND.—The St. Gall-Speicher-Trogen Railway Co., of Trogen, has obtained a concession for the construction of a single-track, metre-gauge electric railway, 5½ miles long, on the St. Gall-Walzenhausen route, *via* Trogen and Heiden, with a branch from Kaien to Rehetobel. The concession will expire on May 16th, 1949. The line is to be built in two sections: (1) Trogen to Heiden, including the above-mentioned branch, and (2) Heiden to Walzenhausen. The total cost of the work is estimated at £43,000.—*Board of Trade Journal.*

SPAIN.—The Compania Nacional de Tranvias has applied for a concession for the construction of an electric tramway in Barcelona, called the Sans Extension, being an extension of the company's existing lines.—*Board of Trade Journal.*

Cradley Heath.—The U.D.C. has decided that it is desirable to enter into an agreement with the Dudley, Stourbridge and District Electric Traction Co. for the construction and working of a tramway from Brierley Hill to Cradley Heath, if satisfactory terms can be arranged between the company and the Brierley Hill, Quarry Bank, Rowley Regis and Cradley Heath Councils.

Falkirk.—Owing to the severe gale which visited the district on the 14th inst., many trees were blown down on to the telegraph wires and tramway trolley lines, completely blocking the tramway service in places. The obstructions were removed and services renewed on the 15th inst.

Handsworth.—The District Council, at a meeting last week, considered a report dealing with complaints against the South Staffordshire Tramways (Lessee) Co., against whom action has been taken; also an application to Parliament for powers to construct a network of tramways in the district.

The Parliamentary Committee has been notified that the Birmingham City Council proposes to make representations to the L.G.B. with respect to the extension of the city boundaries (in which the U.D.C. does not acquiesce).

Leeds.—At the meeting of the Corporation Tramways and Electricity Committee on Monday, reference was made to the success of the year's working in the tramways department. The half-yearly statement was satisfactory, and there was promise of another good financial year. There has been a fairly substantial increase in revenue to meet extra expenditure necessitated by repairs and renewals of permanent way. An application has been received from Otley for the extension of the tramway system to that boundary from Guiseley, and the matter has been placed in the hands of a committee. Mention was made of a proposed extension of the electricity undertaking to Thwaite Gate, and questions were also under consideration regarding the supply of electric power for sewerage plant on the new estate at Templenewsam, and for similar works at Headingley, so that there were indications of very considerable future progress.

London.—The L.C.C. on July 16th, 1907, concurred in the proposal to refer to arbitration the question whether the expense incurred by the G.P.O. in providing heat coils, fuses, &c., for the protection of telephone and telegraph wires in the neighbourhood of tramways worked on the overhead trolley system of electric traction, should be borne by the Post Office or by the tramway authority concerned. The arbitrator appointed by the B. of T. has now decided that the cost shall be borne by the latter. The case for the tramway authorities was undertaken by the Tramways and Light Railways Association, and by the award the Association is required to pay half the arbitrator's fee in addition to its own costs. The Council is to pay £10 to the Association as a contribution toward the costs incurred by it in the arbitration proceedings.

The City and South London Railway has introduced a reduced scale of fares to season-ticket holders, and with a view to accelerating the traffic, experiments are now being made with automatic signals.

Lower Bebington.—The U.D.C. has under consideration the question of the extension of the Birkenhead tramways from New Ferry to Bolton Road, Port Sunlight.

Newcastle-on-Tyne.—As a result of the measures taken by the tramways manager to carry out the reduction in working expenses decided on by the Tramways Committee, the employés are going to lodge a protest with the latter against reducing the staff.

When entering Manors North Station on Wednesday evening last week, an electric train left the metals and tore up the permanent way for some distance. Two of the carriages were considerably smashed, and a young man was injured.

Queensferry (Edinburgh).—At Linlithgow C.C. recently a letter was read from Messrs. Deas & Co., asking whether the Council would consent to a tramway being constructed between Cramond Brig and South Queensferry. The chairman explained that about four years ago a company applied for a provisional order to lay a tramway over the same road, and the Council opposed the scheme on the ground that the road was not wide enough for a tramway and the ordinary traffic. After discussion, it was agreed that the clerk should acknowledge the letter, and that any further communications on the subject should come before Linlithgow District Committee.

Swindon.—The T.C. has decided to offer a bonus to tramway motormen on their attaining a minimum consumption of energy, as fixed by the Committee for the tramways.

West Fife.—The tramway company is pushing ahead with the new tramway system. Immediately after the B. of T. inspection it will commence a service between Cowdenbeath and Dunfermline. The system will then be extended, and before the end of the year Lochgelly will also be linked up.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Postal Department has twice invited tenders from manufacturers who are prepared to supply telephones made in Australia, but so far no tenders have been received. The Government is most anxious to have the instruments made in the Commonwealth.

It is estimated that in order to put the telegraph and telephone systems of the Commonwealth in a state of high efficiency, an expenditure of £1,828,152 would be necessary, to meet existing requirements alone. Speaking on the subject in the House of Representatives, Mr. Reid said that the Postal Department had got its bad reputation because it had never had a chance to do its work properly. The officers were not inefficient, but had not been afforded an opportunity to show what they could do, and had never had the proper appliances for the work.

Bahamas.—The annual Colonial Report for the Bahamas for 1908-9 states that the revenue of the Telegraph Department was £1,668 and the expenditure £548, as against £1,248 and £545 respectively; 4,251 messages were dealt with, 377 of which were to and from Great Britain. The previous year's traffic was 3,847 messages.

There are 225 telephone stations now working in Nassau and suburbs. The revenue for 1909-10 is put at £912 10s. and expenditure (inclusive of interest and sinking fund) at £516 16s. The system is owned by the Government.

Brazil.—The *Brazilian Review* reports that the contract between the Government and the Amazon Telegraph Co. for the duplication of the subfluvial cable between Para and Amazonas was signed on September 28th. The work is to be completed within 15 months, and a reduction of 20 per cent. in the rates, or 30 per cent. if the traffic exceeds 600,000 words per annum, is to be made.

Cable Interruptions:—

Tourane-Amoy	June 17, 1909
Assab-Perim	July 8, 1909
Dakar-Conakry	Aug. 20, 1909
Balikpapan-Kwandang	Sept. 2, 1909
Cheiksaid-Perim	Sept. 15, 1909

Canada.—Yesterday the King was to perform the ceremony of opening the doors of the Royal Edward Tuberculosis Institute in Montreal by "touching a button" at West Dean Park, Chichester. The shortest line of the Commercial Cable Co. was to be employed, with relays and repeaters at all intermediate points, so that the signal would go through without manual aid from start to finish. It is believed that this is the first occasion on which an opening ceremony has been performed by wire at a distance of 3,000 miles.

The extension of rural telephone lines in Ontario and the West has been astonishing. These lines, usually 10 to 20 miles in length, are built by the farmers, who find the poles and give free right of way, doing all except the technical work themselves, so that the great advantage of telephone communication costs the rural people very little.

French Postal Strike Sequel.—It is reported that the new Minister, M. Millerand, has reinstated 455 of the 586 post office servants who were dismissed in connection with the postal strike last March. The opportunity has been taken to leave out employés not recommended by their former chiefs.

South Africa.—The system of farm telephones which has proved so successful and advantageous in Canada and the United States has attracted attention in South Africa, and the various Governments have been approached with a view to its introduction.

The falling off in telegraph traffic has enabled the Government of Cape Colony to give additional facilities for trunk telephone service, with the aid of the telegraph wires set free.

Wireless Telegraphy.—The Admiralty have decided to erect a wireless telegraph station at Wick. An acre of ground has been leased and provision will be made for a staff of 12 men. The station is to be equipped with the latest appliances for long-distance communication, and is expected to be in working order early next year.

It is reported that the airship "Zeppelin III" has been proved capable of communicating by wireless telegraphy with stations at a distance of 300 miles. Nevertheless, the experts consider that, to ensure successful communication, wood must be substituted for aluminium in the construction of the frames of airships of the rigid type.

Wireless Telephony.—Under the heading "Caveat Emptor," the *Cape Times* of September 15th severely criticised a prospectus issued by the Collins Wireless Telephone Co., of Newark, U.S.A. It was stated in the prospectus that the capital of the company was £200,000, divided into 1 million shares of $1 each, of which the inventor of the system concerned—Mr. A. F. Collins—had retained 600,000, while, according to the special representative of the company in Cape Colony, of the remainder 250,000 had been sold in America and foreign countries. Mr. J. J. Kelly, the representative in question, was placing these on the market in South Africa at 13s. each. The *Cape Times* drew attention to several discrepancies in the statements issued on behalf of the company, and to the magnificent claims to the effect that the profits from subsidiary companies were estimated in millions during the next few years.

CONTRACTS OPEN and CLOSED.

OPEN.

Alsace.—November 1st. The municipal authorities of Forbach are inviting tenders for the concession for the establishment and working of an electric tramway in the town.

Altrincham.—October 23rd. Electric light installation at the County High School for Girls. Sankey & Cubbon, architects, 4, Chapel Walks, Manchester. (Returnable deposit £1 1s.)

Australia.—Victoria.—Accumulators for the P.M.G. See "Official Notices" October 1st.

Victoria.—Electric lamps for the P.M.G. See "Official Notices" October 15th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" September 24th.

Belgium.—December 31st. The municipal authorities of Jupille are inviting tenders for the concession for the lighting of the little town by gas or electricity.

Epsom.—November 2nd. Eight D.C. long-burning flame arc lamps for the U.D.C. See "Official Notices" to-day.

Llandudno.—October 30th. Hand tower-ladder for trimming arc lamps, for the U.D.C. See "Official Notices". October 15th

L.C.C.—November 1st. Brass and other castings and fittings, lamp glasses, carbons, insulating materials, cables and lamps, for the L.C.C. See "Official Notices" to-day.

Leyton.—October 26th. Installation of electric light and water heating apparatus at the Canterbury Road Schools, now erecting, for the U.D.C. See "Official Notices" October 8th.

London.—November 3rd. Electric lighting installation at the Buxton Street Elementary School, Whitechapel. See "Official Notices" to-day.

Luton.—October 29th. Vulcanised bitumen cable for the Corporation. See "Official Notices" to-day.

Manchester.—October 25th. Steel girder tramway rails, for the T.C. (returnable deposit, £1 1s.); J. M. M'Elroy, General Manager of the Tramways, 55, Piccadilly, Manchester.

Mountain Ash.—October 25th. Electrical stores for the U.D.C. electricity undertaking. See "Official Notices" October 8th.

Radcliffe.—October 27th. Cable for the U.D.C. Electricity Department. See "Official Notices" October 15th.

Rotherham.—October 23rd. The T.C. has two steam dynamos, 32 kw. each, for disposal. See "Official Notices" September 24th.

Turkey.—November 30th. The municipal authorities of Broussa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Warrington.—November 2nd. Arc lamp lowering gear for the Corporation Electricity Department. See "Official Notices" to-day.

CLOSED.

Barnes.—The District Council has accepted the tender of the Union Cable Co., Ltd., at £413, for 1,760 yards of cable.

Belgium.—La Société des Ateliers de Constructions Electriques, of Charleroi, has just secured a contract from the Société des Forges de Clabecq (Belgium) for the establishment and equipment of a large electric power plant. The contract includes three dynamos of from 1,100 to 1,600 kw. capacity, six electrically-operated pumps, three electric motors of about 1,200 h.p. each for the operation of the rolling mills, and seven electric cranes.

Bootle.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cables, at £815.

Burslem.—The T.C. has accepted the following tenders:

Mr. Jas. Grant, Burslem.—Extension of the electricity works, £1,400.
Messrs. Babcock & Wilcox, Ltd.—Boiler, £1,100; and pipework, £118.
Messrs. Siemens Bros. Dynamo Works, Ltd.—Belliss-Siemens generator set, £2,922.
I. Storey & Sons.—Condenser, £1,600.
Messrs. Crompton & Co., Ltd.—Switchgear, £100.

Glasgow.—The T.C. Committee on Sewage recommend for acceptance the offer (£3,869) of Messrs. Lowdon Bros. & Co., Glasgow, in connection with the electric power contract for Shieldhall sewage works.

Government Contracts.—During the past month the following contracts have been accepted by the Government Departments named:—

War Office.

Electric lamps.—Edison & Swan United Electric Light Co., Ltd.; British Thomson-Houston Co., Ltd.
Telephone sets and parts.—British Insulated and Helsby Cables, Ltd.

General Post Office.

Paper core cable.—British Insulated and Helsby Cables, Ltd.; Johnson and Phillips, Ltd.
Cables, submarine.—Telegraph Construction and Maintenance Co.
Detectors and leather cases.—General Electric Co., Ltd.
Generators.—International Electric Co.
Wire, copper, hard drawn.—T. Bolton & Sons, Ltd.: British Insulated and Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated with the London Electric Wire Co., and Smiths, Ltd. Wilkes, Son and Mapplebeck, Ltd.

Johannesburg.—The following tenders for electrical supplies have been accepted by the municipality:—

Dick, Kerr & Co.—Tramway spares, £650.
Telegraph Manufacturing Co.—Two tramway feeder pillars, £45; 2,700 yards ·0025 armoured cable, £145; 2,700 yards troughing, &c., £1,845; 100 yards ·5 cable, £87; 200 yards ·25 cable, £104; 150 pairs fuse-boxes, £62; overhead tramway sundries, £.55; 19 disconnecting boxes, £.07.
Blane & Co.—Five electric freight-cars, £2,695; 1,000 yards ·006 cable, £60.
Henley's S.A. Telegraph Co.—500 yards ·125 cable, £16½; 300 yards ·13 cable, £10½; 2,300 yards ·05 cable, £405; 500 yards ⅛ single cable, £43.
Western Electric Co.—Four 100-kw. transformers, £351.
Reunert & Lenz.—Four tons insulating compound, £86.

London.—L.C.C.—The Education Committee has received the following tenders for installing electric light, &c., at Paddington Technical Institute:—

Brit. West. E. & M. Co. (accepted)	£259	G. Harland Bowden & Co.	£306
Whitehead Bros.	260	D. J. Macdonald	310
Tilley Bros.	266	M. S. Smith	311
R. Bridger	268	Johnson & Phillips, Ltd.	313
Westminster Ventilating Co.	280	W. A. Lawrence	320
Pinching & Walton	290	G. Weston & Sons	349
B. H. and J. Pearson, Ltd.	296	R. N. Cunningham & Co.	376
Foote & Milne, Ltd.	298	E. E. Beaven	378
Sweet Bros.	299	T. L. Hellyar & Sons	447

The British Westinghouse Co. are authorised to sub-let the wiring to G. Foster, Curtis & Co. (Camden Town).

In connection with the electrical equipment for the L.C.C. Paddington Technical Institute, tenders were invited by the L.C.C. from six firms for the supply of a condensing plant. Three of the firms, however, stated that they had not suitable patterns, and they did not therefore submit tenders. The tenders received were as follows:—

Isaac Storey & Sons, Ltd. (accepted)	£216
J. H. Carruthers & Co.	270
Clarke, Chapman & Co.	439

Lowestoft.—At the last meeting of the Council, the Electricity Committee recommended the acceptance of the tender of Messrs. Aubert Grenier & Co., at £783, for feeder cables. The recommendation was referred back with instructions to the Committee to call for fresh tenders. Two Babcock & Wilcox chain grate stokers are to be provided to boilers at a cost of £330. The Council has accepted the tender of the Vacuum Oil Co. for the annual supply of oils to the electricity undertaking at the following prices:—Cylinder oil, 2s. 4d. per gallon; crank chamber oil, Vacuum Etna engine, 1s. 4d. per gallon; 600 W, 2s. 4d. per gallon.

Randfontein.—The Randfontein Estates Gold Mining Co., of Johannesburg, have accepted the tender of the Telegraph Manufacturing Co. for the supply of various cables, amounting to about £18,000; also 20 section pillars. The total lengths amount to about 70,000 ft. of E.H.T. three-core paper-insulated cable, for a working pressure of 6,600 volts; the sizes range from ·1, ·125, ·2, and ·25, and the price includes both the laying and jointing. The same firm is also carrying out the laying of cables for light and power for the Admiralty at the Simonstown new docks.

Swinton and Pendlebury.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for a refuse destructor, at £6,730. The Horsfall Destructor Co. tendered at £6,764.

Taunton.—The T.C. has accepted the tender of Messrs. C. Goodland & Sons for 2,500 tons of coal, at 15s. 4d. per ton, for the next 12 months.

FORTHCOMING EVENTS.

Physical Society.—Friday, October 22nd. At 5 p.m. At the Royal College of Science, South Kensington, S.W. Paper "On Cadmium Amalgams and the Normal Weston Cell," by Mr. F. E. Smith, and other papers.

Institution of Electrical Engineers (Manchester Section).—Friday, October 22nd. At 7.30 p.m. At Midland Hotel, Manchester. Opening meeting for the session. Address by the chairman, Mr. S. J. Watson. A smoking concert to follow. [Other meetings will be held at the Physical Laboratory of the Manchester University.]

Electro-Harmonic Society.—Friday, October 22nd. At 8 p.m. At the King's Hall, Holborn Restaurant. First smoking concert of the season. See "Notes" last week.

Institution of Electrical Engineers (Leeds Section).—Wednesday, October 27th. At 7.15 p.m. At the University, Leeds. Presidential address by Mr. W. M. Rogerson, and a paper, "Notes on Superheated Steam," by Mr. A. B. Mountain.

Institution of Mechanical Engineers.—Friday, October 29th. At 8 p.m. Extra meeting. Resumption of discussion on Prof. W. E. Dalby's paper on "Heat Transmission."

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 31st, 1909:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, October 25th.—"A" Company. Hopkinson Cup competition, 7 p.m.

Tuesday, October 26th.—"B" Company. Hopkinson Cup competition, 7 p.m.

Wednesday, October 27th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 28th.—"C" Company. Hopkinson Cup competition, 7 p.m.

Friday, October 29th.—"D" Company. Hopkinson Cup competition, 7 p.m.

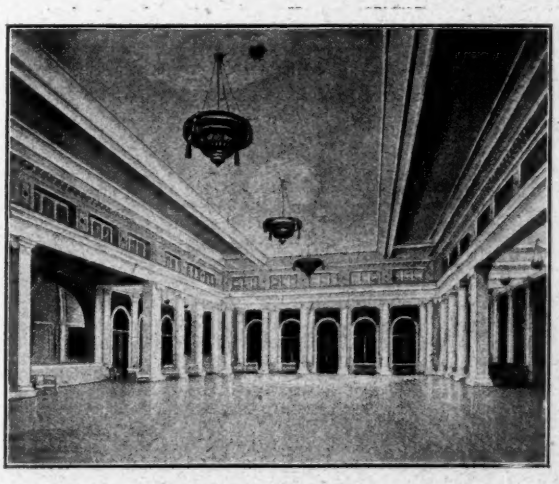
(Signed) P. H. Campbell, Capt. R.E. and Adjutant, For O.C. E.E., L.D.

NOTES.

Late Legal.—Electric Peat-Coal Case Appeal.—An appeal by the defendant, Mr. George Darlington Simpson, from a verdict and judgment in the action of J. C. Barker *v.* Earl Mayo and Others, tried by Mr. Justice Lawrence and a special jury, was in the lists for hearing before Lords Justices Vaughan-Williams, Buckley and Kennedy on Wednesday. On it being called on, Mr. Thompson, representing Mr. Simpson, asked for an adjournment. There had, he said, originally been an appeal by the plaintiff, and Mr. Simpson, thinking he would have the benefit of counsel representing the other defendants, intended to appear in person. A few days ago, however, he was informed that that appeal would not be proceeded with. Being alone on this appeal, he desired the assistance of counsel, but had not yet had time to give the necessary instructions. Their Lordships allowed the appeal to be adjourned for a fortnight.

The British Aluminium Co.—Mr. Justice Swinfen Eady, in the Companies' Winding-up Court on Tuesday, had before him the petition of Dick, Kerr & Co., Ltd., and A. Schonfield & Co., for the compulsory winding up of the British Aluminium Co., Ltd. Mr. Younger, K.C., said he appeared for the company on both petitions, and he had to ask that they should stand over for another month. The petitions were originally presented in July last. The company was of very great magnitude, and was doing a very great business. It was very desirable that there should be a proper reconstruction, the figures to be dealt with being enormous. A scheme of arrangement had been sanctioned, but it was necessary that the arrangement should be further matured. Mr. Martelli, for the petitioners, said he did not oppose, and his Lordship agreed to the adjournment, as requested by Mr. Younger.

Indirect Illumination.—Our American electrical contemporaries have lately alluded to an interesting example of indirect illumination by tungsten lamps. The *Canadian Electrical News* says that indirect illumination in its most recent application consists in entirely covering the source of light with a scientifically-designed mirrored reflector which casts the light on the ceiling, whence it is distributed back throughout the room. This gives the nearest approach to daylight ever secured by artificial illumination. This method is in use in many residences, offices, banks and hotels, and has recently been installed in the new ball-room or auditorium of the South Shore Country Club, of Chicago, one of that city's largest clubs. This is a magnificent separate building connected by a passage-way with the main club house, and is 86 ft. × 140 ft. in size, constituting practically one large room. A 12-ft. promenade, as shown, on all four sides, is separated from the main room by 30 Ionic columns. The ceilings of this promenade are



The Lighting of a Chicago Ball-Room.

20 ft. high, divided in 12-ft. panels. In each of these 28 panels is hung a fixture, containing a single "I-comfort" indirect illuminating unit, as shown. The ceiling of the main auditorium is 28 ft. high, and, as shown in the illustration, contains three large chandeliers hung at equal distances in the large panel of the ceiling. Each of these chandeliers contains 23 "I-comfort" indirect lighting units. The passage-way to this building from the main club house is illuminated with three fixtures in each cross panel, each fixture containing a single indirect lighting unit. Every one who enters the auditorium is immediately impressed with the magnificent results obtained. Many expressions as to its being the most beautiful illumination seen in any part of the world are heard, and not one who sees it but realises that a great advance step has been made in interior illumination. During a ball the scene is one of unusual splendour. The colours of the different gowns are brought out with a distinctness that is most surprising. Plans were originally prepared to light this auditorium by direct illumination, and the cost of the direct lighting fixtures approximated $2,000. The fixtures containing the indirect

light units cost complete, installed, about one-half this sum. The 97 "I-comfort" inverted units used in this installation (69 in the three large central chandeliers and 28 in the small fixtures around the promenade) each using a 100-watt tungsten lamp, make a total of 9,700 watts. At 8 cents per KW.-hour for current, it will be seen that the cost of illuminating this space is but 77 6/10 cents per hour. The fixtures are made of composition (instead of solid metal), such as is coming into general use in European countries, where elaborate designs are desired, and are given a metallic finish that similates a solid metal fixture.

Municipal Undertakings in Germany.—A consideration of the question of municipal socialism in various countries has just formed the subject of articles published by the *Kolnische Zeitung*. As far as Germany is concerned, it is stated that municipalisation has become the work of communal bureaucracy, and that the principal object now is to municipalise the means of transport, particularly the tramways. According to Herr Fuchs, the development of electricity works, on the other hand, has proceeded too rapidly, especially in the small towns, under the pushing influence of large electrical works which desire to earn money by supplying the equipment, but not by operating the works. Thus, a reaction in favour of private industry has already occurred by the advent of the Rhenish-Westphalian Electricity Works Co., and its agreements with various Rhenish towns in regard to supply and participation in the profits. This company enjoys the most favourable conditions imaginable for producing on the cheapest scale, in consequence of a direct connection with collieries, coke works, and power works, whereby economy in coal is gained, and coal freights are avoided. Being enabled to sell at low prices, the company has secured a number of large consumers whose requirements, according to time and quantity, are so far equalised that the power station on the whole is said to be uniformly loaded during each hour of the day and night. The situation is rendered all the more complete by the mutual agreements with some large industrial companies which have their own generating plant, so that both parties need not install standby plant. Instead of embarking upon a contest with the small communal works in the district, the company succeeded in concluding agreements of long duration with various towns on the basis that the communal works should undertake the sole supply of energy for lighting and of power to consumers on a small scale, leaving the custom of the large power users to the company which also undertook to furnish energy to the communes, and to give them a share in the profits. Such agreements offered undeniable advantages to the towns concerned, as they were thereby enabled to utilise their plant to the fullest capacity, and at the same time have current at their disposal in any required quantity. As a consequence, not only small localities, but also such towns as Essen and Mulheim have become associated with the company, and certain towns have subscribed a large portion of the share capital, whilst others merely appear as large consumers acting as distributors in their respective districts. The agreements within the limits already mentioned, give the company the exclusive right for a number of years. As soon as this development had shown that the combination of large areas of supply was more economical than the establishment of small individual stations, a new departure in public activity began in this particular branch, in the sense that various communes united to erect joint works, as, for instance, the Mark Electricity Works, but these works have not been in existence sufficiently long in order to form an opinion of their prospects. It is added that the 2,590 German communes (2,309 town, and 281 country), are provided with electricity works to the extent of 40·7 per cent., and 41·1 per cent. of these are owned by the local authorities. All towns having a population in excess of 50,000, are equipped with electricity works. In the case of tramways, not one-half of the undertakings in towns of 50,000 to 100,000 inhabitants, or even in towns having a larger population than 100,000, is under municipal ownership or working, and municipal and private tramways are often to be found in the same town.

Electricity in American Mining.—In the *Mining and Scientific Press* of San Francisco, we find the following:—"Electricity is being more and more substituted for steam in mining operations, and in many situations notable economies result. At the Butte-Balaklava the saving is estimated at more than 60 per cent. At the Tucson Mine in Leadville it is reported at over 70. These great savings are possible because of the high cost of steam in isolated plants. In Colorado, temporarily, there is more power available than the market demands. The completion of the Shoshone plant and the building of transmission lines of the Central Colorado Power Co. has made electric power available in Lake, Summit, Clear Creek and Gilpin counties at a time, when, for various reasons, mining is less active than usual. The cheapness of the new power is a not unimportant influence in the mining revival which is beginning in these old districts. Incidentally, it is interesting to know that a recent comparison of rates shows that, for the smaller installations, this electricity developed by water-power and transmitted 100 miles or so across the mountains, is being sold at approximately the same rates as by the Commonwealth-Edison Co. in Chicago, where the electricity is steam-generated from coal hauled 100 miles across the prairies. This is one way of removing mountains."

A Manchester Charge.—With further reference to this prosecution, which was mentioned on page 602 last week, the hearing was resumed on Tuesday. Several witnesss were called, the result being that all the defendants were committed for trial at the Sessions.

Electric Lighting at Doncaster Aviation Grounds.—The grand stands and other permanent buildings on the Doncaster Race Course are lighted by gas, as they date from pre-electric lighting days, and have not been modernised in accordance with the spirit of the times, except by the addition of an electric lift for the use of the King, when he patronises a race meeting. The hangars or sheds for the accommodation of the aeroplanes are, however, new and temporary buildings; accordingly provision had to be made for lighting them, so that the mechanics might be able to make adjustments and repairs after dark. Also it was essential that these machines should be guarded by night to prevent either wanton destruction or acidental fire; so light had to be provided for the use of the watchmen and mechanics. The latter never leave their machines, and when not working, sleep alongside the aeroplanes they are in charge of. Owing to the light, inflammable nature of flying machines, and also on account of the petrol used as the fuel for the engines, the only form of illuminant that can be considered is, of course, electric light. At Rheims Aviation Meeting, which was held at a distance of some four or five miles from the town, a portable steam plant was installed to drive the electric generator. The Doncaster Corporation have gone one better, for at very short notice they have arranged to light the hangars off a traction feeder (not having a lighting feeder within reach). Two drums of cable for some street lighting extensions had just been delivered, so this cable was laid on the surface of the ground between the terminals of the traction feeder, and the temporary sub-station at the hangars, a distance of several hundred yards. This cable was protected by boards laid over it. A 15-H.P. 460-volt motor, constructed by Electromotors, Ltd., of Manchester, was connected by belting to a 40-ampere 220-volt dynamo of Rhodes make, so that the voltage employed in the hangars might be kept within safe limits. As the load on the racecourse tramway feeder is but a small one after dark, no special voltage regulator was rigged up, beyond a water resistance and an ordinary shunt regulator, which will be hand regulated by a switchboard attendant. The switchboard used sees service normally in the electricity works test room. Inside the hangars incandescent lamps are provided, while outside the fronts of these buildings, which are in a line, four flame arc lamps are installed. In Mr. Cody's hangar, in accordance with this aviator's instructions, what he calls search-lights are fitted up. These merely consist of a bunch of lamps under one reflector, which is tilted so as to throw the light on the part of the aeroplane upon which the mechanics happen to be working. Everything connected with the Doncaster Aviation Meeting seems to have been hurried and rushed, so great credit is due to the borough electrical engineer, Mr. E. S. Rayner, and his staff for the promptitude with which they formulated and carried out a scheme for the electric lighting within a very brief period after the time at which the Aviation Committee discovered that artificial lighting was essential. The work was actually completed before the temporary sub-station structure—a lean-to on one of the hangars—was ready, and before the hangars were in shape to receive the machines.

Institution and Lecture Notes.—Institution of Electrical Engineers (Leeds Local Section).—The programme for the new session has been received, and includes the following items:—

October 27th, at Leeds.—Presidential address by Mr. W. M. Rogerson. Paper by Mr. A. B. Mountain: "Notes on Superheated Steam."

November 17th, at Sheffield.—Paper by Mr. W. T. Maccall: "Some Experiments on Single and Stranded Fuses."

December 15th, at Leeds.—Paper by Mr. G. Wilkinson and Mr. McCourt: "Metallic-Filament Lamps."

January 26th, 1910, at Sheffield.—Paper by Mr. H. E. Yerbury: "Equitable Charges for Tramway Supply."

February 23rd, at Leeds.—Paper by Mr. W. B. Woodhouse: "Notes on Overhead Lines."

March 16th, at Sheffield.—Paper by Mr. E. S. Saunders: "Electrical Machinery for Iron and Steel Works."

April 20th, at Leeds.—Annual general meeting.

Institution of Electrical Engineers (Manchester Local Section).—The opening meeting of the present session will be held to-day at the Midland Hotel, when the chairman, Mr. S. J. Watson, will deliver his address, and the smoking concert will follow. The next meeting will be held on November 2nd at the University.

The Manchester Students' Section will open the session with a supper and smoking concert on November 9th.

Institution of Electrical Engineers (Glasgow Local Section).—We have received the programme for the new session, which opens on November 16th, with the chairman's inaugural address. The annual dinner will take place on December 1st. The Students' Section opened on Friday last.

Association of Engineers-in-Charge.—On Wednesday evening, October 13th, Mr. Henry Adams, M.Inst.C.E., read his presidential address before a very large and interested audience at the Institute (St. Bride's). The title of the address was "Standardisation," and Mr. Adams dealt with the matter from many points of view, giving the engineers plenty of useful information to deal with at their first discussion evening of the session (Saturday, October 30th). It is interesting to note that specific dates have been assigned to these instructive evenings, which no doubt will enable members to arrange to keep the dates open more freely than if this had not been done.

American Society of Mechanical Engineers.—The annual meeting of the society will be held in the Engineering Societies Building, New York, December 7th to 10th, 1909. Papers are to be

presented on electric driving, discussing the economic as well as the technical phases of the subject; upon apparatus for the measurement of flow of air, steam and water; tests of lubricating oils, steam turbine nozzles and steam turbines; governing rolling-mill engines; the use of moist fuels; boiler joints, pump valves, a new type of pile-driver, and other engineering subjects.

Motorist Committed for Trial.—At Dartford on Monday, Mr. Clifton Robinson, son of Sir J. Clifton Robinson, of the London United Tramways, Ltd., was committed for trial at the Maidstone Assizes, bail being allowed, on a charge of causing the death of Thomas Goulding and his wife by running into them with his motor-car while they, accompanied by their seven children, were returning to London after hop-picking at Malling.

Whitworth Scholarships.—Scholarships (tenable for three years) have been awarded to Arthur W. Judge, John Airey, Henry S. Rowell and Hubert Mawson.

German Electrical Works.—According to a Berlin Reuter dispatch, it appears that statistics have just been issued by the Union of German Electrotechnicians, showing that there were on April 1st last 2,050 electricity works in Germany, providing with power not only the places where they are situated, but also 2,600 places in their vicinities, in all 4,650. The total capacity of Germany's electrical works amounts to 1,200,000 KW. In Germany there are 93 works with a capacity of more than 2,000 KW. About two-thirds of the existing works are in private hands, the other third belonging to the municipalities or the State.

The Copper Market.—Mr. Thomas W. Lawson, of *Frenzied Finance* fame, has recently issued another manifesto dealing with the copper market and the rumours which have been in circulation regarding important pending developments. He says that the big copper deal which has been hinted at during the past six months is the formation of a copper metal trading company with a capital of $150,000,000. This company will confine its business to buying, selling and trading in metal. It is claimed that it will be able to control 1,500,000,000 to 2,000,000,000 lb. of copper; that it will buy on low markets and sell on high, thus minimising violent fluctuations in the metal price, and thereby enabling producers and consumers alike to plan ahead intelligently. The bulk of the new company's stock will be owned by the large producers; the company's management will be two of the most representative copper producers and one of the great copper users, and one of the prominent electrical magnates will be on the board of directors. One of the principal features of the new enterprise, and one that is expected to work radical changes in the conduct of the copper trade in the United States, will, it is said, be the issuing of warehouse receipts for the metal.—*Ironmonger*.

Inquiry.—A correspondent inquires for the makers of "Dermatine" and "Durite."

Concert.—At Swadlincote Town Hall on October 6th, the second annual concert in aid of the funds of the Burton and Ashby Light Railway Athletic Society was held. The arrangements were in the hands of Mr. Wm. Barton, chief clerk, and Mr. R. O. Baldwin, traffic manager, of the Light Railways Department.

Model Exhibition.—An exhibition of engineering models, promoted by the Society of Model Engineers, was opened on Friday last at the Royal Horticultural Hall, by Sir Hiram Maxim. Among the exhibits—some of which were as much as 16 ft. in length—was the "Antiforge" pen, which writes by perforating the paper with an electric spark. The British School of Telegraphy showed a wireless installation, with which, on the opening day, communication was accidentally established with an Atlantic liner.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Morecambe T.C. on Monday decided to appoint MR. WM. RYDE WRIGHT, of London, as consulting engineer for the electrical undertaking for two years, at a fee of 100 guineas per annum, and 3½ per cent. commission on any further capital expenditure.

MR. J. R. S. BARKSHIRE, resident electrical engineer at the Royal Naval Ordnance Depôt, Bull Point, was married on September 25th last, at the Stonehouse Wesleyan Church, to Miss Mabel Westlake, of Stonehouse.

There was recently a heated debate in the East London Town Council over the position of the electrical engineer with that body, during which personalities were freely indulged in. Ultimately the following resolution was carried, with two dissentients:—"That the Council proceed to enter into an agreement with the electrical engineer in terms of his letter, and that the special remuneration be paid, provided that the electrical engineer prove to the Council that the cost of generating current does not exceed 2½d. per unit in terms of his report." The terms of MR. LAMBE'S offer are that he shall be paid at the rate of £510 per annum, together with a special remuneration of £350 in connection with the relaying of the tramways track and the equipment of the West Bank power station.

MR. R. MACAULAY, of the Durban municipal electric power station, has been appointed station engineer at the Bloemfontein electric power station; on leaving Durban he was presented with a gold watch and case of pipes as a token of regard by his fellow employés, with whom he had been associated for over seven years.

MR. H. HEARN, of the Natal Government electric power station, has been appointed electrical engineer to the Municipality of Kroonstad.

The following appointments have been made in connection with Marylebone electricity undertaking:—MESSRS. K. A. E. BOSHELL (general manager's private secretary and personal clerk), £3 17s. per week; C. B. METZNER (filing clerk), £1 10s.; W. S. HIND (representative), £2 15s.; A. PALMER (representative), £2; G. MEDWORTH (representative), £2; J. THOMPSON (clerk), £2; H. MORREY (do.), £1 12s. 6d.; W. E. BARTER (do.), £1 15s.; T. E. WHITE (do.), £1 15s. The seven officers last-named belong to the Sales Department. The Electricity Committee has considered a letter and memorial from four members of the staff complaining of their dismissal by the general manager, and asking that an opportunity be given them for resignation, and that their cases may be considered under the Superannuation Act. The Committee has decided, in view of the powers of appointment and dismissal conferred upon the general manager, that his discretion cannot be interfered with. As to the suggestion that gratuities be awarded under the Superannuation Act, the Committee did not think that any action should be taken.

Tramway Officials.—MR. W. HUNTON, assistant engineer, was on Thursday last presented with a case of razors and set of instruments by the staff and employés of the Sunderland District Electric Tramways, Ltd., on his leaving the company's service.

The employés of the Brighton Corporation Tramways Department on 14th inst. presented a number of useful gifts to MR. W. N. BROOKES, traffic superintendent, on the occasion of his marriage. Mr. W. Marsh, the manager, made the presentation.

General.—MR. JAMES F. GILL has opened an office at 25, Castle Street, Liverpool, as a consulting engineer, and is specialising in power installations, transmissions, and general economy tests.

MR. HOOGHWINKEL, of Messrs. Hooghwinkel, Anthony Brown and Partners, has just returned from Canada, where he has been inspecting an important electric water-power scheme. Mr. Hooghwinkel reports that he is much impressed with the necessity for electrical manufacturers to arrange for proper representation in that part.

MR. J. D. MACKENZIE has taken up the position of manager of the National Electric Signs Co., Ltd., Glasgow.

According to *Indian Engineering*, MR. T. R. ROBERTS, Telegraph Superintendent, M. and S.M.R., has been granted a further extension of service for one year up to October, 1910. The Madras and Southern Mahratta Railway have, besides the telegraph superintendent at Bellary, a telegraph engineer (Mr. H. H. L. Prendergast) stationed at Arkonam.

A marriage has been arranged between MR. J. WALTER SAALER, manager of Messrs. Bruce Peebles & Co., Ltd., Manchester office, and Miss Frances Redfearne Knott, daughter of the late Mr. Walter Knott, of Southsea, and niece of the late Surgeon-Colonel Dr. Knott, medical adviser to the Portsmouth Corporation.

MR. C. S. NORTHCOTE, M.I.E.E., informs us that owing to the lease of 2, Queen Anne's Gate having been disposed of, his present office address is 6, Old Queen Street, Westminster, where he will be pleased to hear from his numerous trade friends, on any business that is likely to interest him.

Obituary.—We regret to learn from friends in Australia of the sudden death, which occurred last month, of MR. OSWALD HAES, of the firm of Haes & Eggers, of Sydney. Mr. Haes, who passed away while on a visit to Melbourne, had been engaged in electrical work in Australia since 1891, when he arrived there from England, as the representative of the Brush Electrical Engineering Co., Ltd. He was a member of the I.E.E., and was a founder of the New South Wales Electrical Association, to the presidency of which he was several times elected. According to the Melbourne *Argus*, Mr. Haes negotiated the purchase in 1899 of the supply undertakings of the New Australian Electric Co. and the A. U. Alcock Electric Light Co. by the Melbourne Electric Supply Co., and the transfer to the City Council of the city portion of these undertakings.

NEW COMPANIES REGISTERED.

Tramways (Conduit) Point Syndicate, Ltd. (105,328).—This company was registered on October 7th, with a capital of £300 in £1 shares, to acquire, deal with and turn to account inventions for improvements appertaining to tramway and railway construction, particularly relating to the conduit point system. The subscribers (with one share each) are:—H. C. Howard, 70a, Basinghall Street, E.C., chartered accountant; Dr. J. MacCormac, Blackwater, Hants, anæsthetist; W. H. Ockenden, 40, Turney Road, West Dulwich, S.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are H. C. Howard (managing director) and Dr. J. MacCormac; remuneration as fixed by the company. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Carmarthen Electric Supply Co., Ltd. (105,409).—This company was registered on October 14th, with a capital of £10,000 in £1 shares (5,000 5 per cent. pref.), to acquire from J. B. Saunders & Co. the benefit of the Carmarthen Electric Lighting Order granted to them under the Electric Lighting Acts, 1882 and 1888, for the supply of electrical energy in Carmarthen, and to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—A. E. Bower, 9, Brockley Grove, S.E., clerk; Miss G. W. Barnett, 8, Tresaillian Road, Brockley, S.E., clerk; Miss M. E. Gill, 91, Wickham Road, Brockley, S.E.; W. A. Schultz 50, Cannon Street, E.C., chartered accountant; C. M. Cockerton, 182, Upper Thames Street, E.C., printer; F. Martin, 29, Queen Street, E.C., solicitor; R. A. Reeves, 68, Raleigh Road, Hornsey, N., clerk. Minimum cash subscription 25 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification of managing director, 100 shares; of ordinary directors, 200 shares; remuneration as fixed by the company. Registered office, Salisbury House, London Wall, E.C.

Anglo-German Wireless Syndicate, Ltd. (105,371).—This company was registered on October 12th, with a capital of £200 in 1s. shares, to adopt an agreement with Baron Egbert von Lepel, Gen. Baron von Gayl and Dr. W. Burstyn and others trading as the Drahtlose Telegraphic-system von Lepel, and to carry on the business of electricians, engineers, battery makers, founders, generators, distributors and workers of and dealers in electricity, land, submarine and aerial telegraphy, &c. The subscribers (with one share each) are:—A. F. Simpson, 7, Stratford Mansions, South Molton Street, W.; G. Elkin, 27, Mill Hill Road, Acton, secretary; W. H. Page, 1, Balcaskie Road, Eltham, gentleman; T. Burrett, 80, Gwynne Road, Clapham Junction, S.W., clerk; F. Thurston, Oakleigh Road, Croydon, cashier; W. Groom, 27, Mayes Road, Wood Green, N., clerk; E. A. Harbert, 1, Spring Villas, Boomfield Place, Ealing, electrician. Minimum cash subscription, £10. The first directors (to number not less than four or more than eight) are Baron Egbert von Lepel, Gen. Baron von Gayl, W. Burstyn, Sir Thomas Myles, Kt., A. Holt and Viscount Massereene and Ferrard; qualification, £1; remuneration, £100 per annum, divisible. Registered office, Audrey House, Ely Place, E.C.

Electric Smelting Co., Ltd. (105,361).—This company was registered on October 11th, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of and dealers in machinery for the treatment of ores and the generating of electricity, &c, to acquire the right to use any secret or other information relating to the treatment and reduction of ores, or relating to magnetic separators, and to adopt an agreement with M. Ruthenburg. The subscribers (with one share each) are:—H. Jacques, 45, Lancaster Road, Kensington, W., clerk; T. W. Doran, 17, Aden Grove, Green Lanes, N., clerk. Private company. The number of directors is not to be less than two or more than five; M. Ruthenburg is one of the first directors and may retain office while holding 1,000 shares. Registered by Ingle, Holmes, Sons and Pott, Capel House, E.C.

Kinetic Co., Ltd. (105,415).—This company was registered on October 14th, with a capital of £5,000 in £1 shares, to take over the business of electrical and general engineers, manufacturers of, and dealers in, electric, water and other engines and apparatus for blowing organs, air compressors and exhausters, &c., carried on by E. J. Jackson and J. H. Swanton at Lincoln, as the Kinetic Co. The subscribers (with one share each) are:—C. Steele, Telegraph Street, E.C., solicitor; S. J. Tilley, Devonshire House, Oxford Road, Kilburn, accountant. Private company. The number of directors is not to be less than two or more than five; the first are E. J. Jackson and J. H. Swanton (both permanent); qualification, 50 shares; remuneration as fixed by the company. Registered office, Rosemary Lane, Lincoln.

Franco-British Electrical Co., Ltd. (105,381).—This company was registered on October 12th, with a capital of £1,500 in £1 shares, to acquire the business carried on at 99A, Charing Cross Road, W.C., as the Franco-British Electrical Co., and to carry on the business of gas, electrical and general engineers, illuminating decorators and contractors, &c. The subscribers (with one share each) are:—A. E. Spearman, 76, Elgin Avenue, Maida Vale, W., clerk; T. J. Alexander, 40, Overhill Road, East Dulwich, S.E., clerk. Private company. Table "A" mainly applies. Registered by W. B. Styer, 11 and 12, Fenchurch Street, E.C.

A. A. Rupprecht & Co., Ltd. (105,433).—This company was registered on October 15th, with a capital of £1,000 in £1 shares, to carry on the business of mechanical, electrical and general engineers, electricians, machinists, founders, &c. The subscribers (with one share each) are:—A. A. Rupprecht, Carlton House, Lower Regent Street, S.W., engineer; E. L. Grant, Carlton House, Lower Regent Street, S.W., engineer; A. R. Martin, Carlton House, Lower Regent Street, S.W., gentleman. Private company. The number of directors is not less than two or more than five; the first are A. A. Rupprecht, E. L. Grant and A. R. Martin. Registered office, Carlton House, Regent Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Munster Electric Lighting Co., Ltd. (100,269).—Particulars of £1,000 debentures created September 17th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, at Fethard and Callan, Ireland. No trustees.

Church Stretton Electric Supply Co., Ltd. (80,857).—Charge dated September 30th, to secure £50 (supplemental to a charge dated March 17th, 1909). Property charged: Certain freehold hereditaments at Crossways, Church Stretton, Salop. Holder: E. Bond, 43, Thurloe Square, S.W.

Goring and Streatley Electric Light and Power Co., Ltd. (101,228).—Particulars of £3,000 debentures created April 20th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Trust deed dated September 14th, 1909, to secure £85,000 6 per cent. prior lien debentures. Property charged: Concessions and immovable property in Costa Rica, and the company's undertaking and property, present and future, including uncalled capital. Trustees: City Safe Deposit and Agency Co., Ltd., 18, Throgmorton Avenue, E.C.

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—This company's annual return was filed on September 30th, when 9,041 shares had been taken up out of a nominal capital of £80,000 in £10 shares. £5 per share has been called up on 1,195 and £10 on 960 shares, resulting in the receipt of £8,475. £5,960 is considered as paid on 596 shares. Mortgages and charges: £6,883 7s. 1d.

Electrolytic Alkali Co., Ltd. (64,360).—Issue on September 27th of £2,950 debentures, part of a series of which particulars have already been filed.

Electro-Mechanical Brake Co., Ltd. (98,276).—A memorandum of satisfaction in full (*a*) of mortgage dated April 15th, 1909, securing £575, and (*b*) of charge dated June 7th, 1909, securing not more than £1,500, has been filed.

Crompton & Co., Ltd. (27,200).—Issue on July 19th of £100 debentures, part of a series of which particulars have already been filed.

Dixon & Corbitt and R. S. Newall & Co., Ltd. (24,238).—Issue on October 1st of £1,700 5 per cent. debentures, part of a series of which particulars have already been filed.

Edmundson's Electricity Corporation, Ltd. (52,013).—This company's annual return was filed on August 31st, when the entire capital of £800,000 in £5 shares (60,000 ordinary and 80,000 preference) had been taken up. £734,000 has been paid on 66,800 ordinary and 80,000 preference, and £66,000 is considered as paid on 13,200 ordinary. Mortgages and charges: £572,000.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—Issue on October 6th of £100 debentures, part of a series of which particulars have already been filed.

Halifax and Bermudas Cable Co., Ltd. (28,972).—This company's annual return, made up to September 30th, has been filed. The entire capital of £50,000 in £5 shares has been taken up. £50,000 is considered as paid. Mortgages and charges: £10,000.

Yale Electric Power Co., Ltd. (60,493).—This company's annual return was filed on October 9th, when 668 shares had been taken up out of a nominal capital of £20,000 in 800 shares of £25 each. £25 per share has been called up on 600 shares, resulting in the receipt of £14,981 5s. £18 15s. remains in arrears. £1,700 is considered as paid on 68 shares. Mortgages and charges: Nil.

Warren, Beattie & Co., Ltd. (70,585).—This company's annual return was filed on September 8th, when 400 deferred and 796 ordinary shares had been taken up out of a nominal capital of £10,000 in 400 deferred and 1,600 ordinary shares of £5 each. £2,300 has been received on 460 ordinary and £3,680 is considered as paid on 400 deferred and 336 ordinary. Mortgages and charges: £2,000.

Dick, Kerr & Co., Ltd. (63,407).—This company's annual return was filed on October 14th, when 305,000 preference and 270,000 ordinary shares had been taken up out of a nominal capital of £650,000 in £1 shares (350,000 preference and 300,000 ordinary). £265,000 has been received, and £300,000 is considered as paid. Mortgages and charges: £265,480.

Metals Corporation, Ltd. (70,569).—This company's annual return was filed on September 2nd, when 17,532 shares had been taken up out of a nominal capital of £25,000 in £1 shares. £1 per share has been called up on 2,492, and £2,425 has been received. £7 remains in arrears. £15,100 is considered as paid. Mortgages and charges: Nil.

Dargue, Griffiths & Co., Ltd. (48,858).—A memorandum of satisfaction in full on July 17th, 1909, of mortgage dated May 25th, 1908, securing the liability under certain guarantees, has been filed. Also charge by way of indemnity on the company's undertaking and property, present and future, including uncalled capital, dated October 2nd, 1909, to secure £3,000. Holder: E. Griffiths, 51, North John Street, Liverpool.

Northampton Electric Light and Power Co., Ltd. (28,640).—Issue on October 12th of £400 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Brisbane City Electric Light Co., Ltd.

The directors' report for the half-year ended July 31st, 1909, which was submitted to the meeting held in Brisbane on September 14th shows that during the half-year the output was 1,035,429 units, as against 960,715 for the corresponding period of 1907, being an increase of 7½ per cent. Comparing the revenue from the sale of electricity for the same periods, the increase has been 11½ per cent., while the revenue from all sources has increased 7½ per cent. The results of the half-year's working have been such, that after placing £500 to the credit of the franchise purchase sinking fund account, £150 to the accident insurance account, and a substantial sum to the credit of renewals, replacements, and contingencies account, there remains a credit balance of £2,686, which, with the balance brought forward from last half-year, makes a sum of £4,622 to be disposed of. The directors recommend that a dividend, at the rate of 6 per cent. per annum, be paid on the preference shares, and a dividend at the rate of 7 per cent. per annum be paid on the ordinary shares, in proportion to the amount paid thereon; they also recommend a bonus at the rate of 2 per cent. per annum on the ordinary shares, in proportion to the amount paid thereon. The payment of the above-mentioned dividend and bonus, together with the dividend duty, will absorb £3,218, leaving a balance of £1,404 to be carried forward. During the half-year, all the machinery and plant, as well as the underground mains, have worked well, and have been maintained in a state of high efficiency, and the thanks of the shareholders are again due to the staff for the good work performed. During the half-year the 700-kw. turbine plant mentioned in the last report has been installed, and has, during the last week, been taken over from the contractors. The anticipation of the directors has been justified in

connection with this plant, as the maximum load in the station increased 27 per cent. during the half-year. Good progress has been made in the extension of mains in the Valley area, and also in the laying of ducts for feeders from the new power house to the Queen Street area. The plans for the new waterside (William Street) power house had been completed by the company's architects, who were at the date of the issue of the report calling tenders for the erection of same.

United Electric Tramways Co. of Caracas.

This company held its meeting in London on Tuesday. The report for the period of 18 months from January 1st, 1908, to June 30th, 1909, which was then submitted, states that the working of the tramways during the time that the electrification of the lines was in progress was carried on for account of contractors, who paid all expenses including the costs of the London administration up to March 15th, 1908, and consequently the accounts of the company commence only from that date. The results of the operations of the local company from March 16th, 1908, to June 30th, 1909, before charging mortgage interest, which is payable to this company and amounted £13,175, were as follows:—Gross receipts £42,000, operating expenses £31,654, net receipts £10,346. The improvement in the political and internal condition of Venezuela is reflected in the steadily increasing passenger traffic of the tramways. The local company is under contract to carry meat from the public slaughter house to the city, but from causes in operation prior to the purchase of the tramways, this service was carried out by a local railway company. The result during the period covered by the accounts was a loss to the local company of Bs. 11,091. This arrangement is now ended, and the local company will in future carry the meat, upon which a considerable profit is anticipated. The total length of track which has been electrified is 13¾ miles. Two miles of new lines are in course of construction, which, when completed, are expected to give facilities for greater economy in working and also a considerable additional traffic. The profit and loss account shows that after meeting interest on the first mortgage debenture stock, paying all costs of administration and placing £425 to sinking fund for redemption of mortgage debenture stock, a balance remains of £894, which is carried forward. The mortgage of the property of the local company to this company has been duly completed and vested in the name of the Consolidated Trust, Ltd., the trustees for the debenture stockholders.

Monte Video Telephone Co., Ltd.

The directors' report for the year ending July 31st last show, after providing for all working expenses in Monte Video and London, a net profit for that period of £19,931, as against £19,401 for the previous year. The interim dividends paid on May 1st last absorbed the sum of £4,343, leaving a balance of £15,588, to which should be added £2,797 brought forward from last year, making an available balance of £18,385. After applying £11,000 to depreciation of the company's property and plant, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving a balance of £3,042 to be carried forward. There has been a moderate increase during the year in the number of subscribers and in revenue.

Cuba Submarine Telegraph Co., Ltd. — The directors' report states that the total receipts of the six months ended June 30th were £17,706, while the expenses amounted to £6,635, leaving a balance of £11,071, to which has to be added £6,788 brought forward from last account, giving a total of £17,859 to be dealt with. The sum of £3,000 has been added to the reserve fund, which now stands at £114,000. The dividend on the preference shares will absorb £3,000, and leave £11,859, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax, the balance, £7,059, being carried forward to the current half-year. An interruption occurred in May to the Batabano-Cienfuegos 1891 cable, which was speedily repaired, and all the cables are now in good working order.

Reduction of Capital.—Electricity Supply Co. for Spain, Ltd.—A petition for confirming a resolution reducing the capital from £205,000 to £105,000 is to be heard in London on November 2nd.

Parsons Marine Steam Turbine Co., Ltd.—A final dividend of 5 per cent. and a bonus of 2½ per cent. are recommended, making 12½ per cent. for the year; £5,000 is written off patent rights, and £10,532 is carried forward.

Austria.—The balance-sheet of the Vereinigte Elektricitäts Gesellschaft, of Vienna, for the last financial year shows a net profit of 599,104 crowns, as compared with 590,035 crowns in the preceding 12 months. A dividend at the rate of 6 per cent. is being maintained.

Ferranti, Ltd.

The directors' report for the year to June 30th, 1909, shows that the profit on trading was £29,218, and after crediting discounts and interests and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, bad debts and directors' and trustees' fees, there remains a balance of £12,240, which has been applied as follows: Interest on prior lien debentures, £818; interest on first mortgage debenture stock, £5,000; interest on bank loan, £1,115; amount charged in respect of depreciation, £5,000 = £11,933, leaving a balance of £307. This sum has been deducted from the balance standing at the debit of profit and loss account at June 30th, 1908, reducing the amount to £1,830. The commercial depression has continued during the whole of the financial year, and the results show a falling off as compared with the previous year.

Prospectuses.—*The Nilambur Rubber Estates, Ltd.*—250,000 shares have been offered for subscription. The company owns among its estate property in Southern India about 3,000 acres suitable for rubber. On 1,029 acres there are planted 132,256 Para rubber trees of ages ranging up to three years.

Cuban Telephone Co.—An issue of £1,050,000 5 per cent. first mortgage convertible bonds has been offered in this country at £92 per cent.

Washington Traction Co.—400,000 shares of $5 each have been offered at £1 each. The company is to construct and operate an 88-mile electric railway in the State of Washington, and to supply electric power for all purposes.

Cleveland and Durham Electric Power, Ltd.—The *Financial Times* Darlington correspondent says that the annual report shows that during the year ended June 30th investments in associated companies increased by £7,987. Capital expenditure on works amounted to £14,084, which small total was due to continued trade depression and consequent diminished amount of new business. The gross profit for the year was £2,098, and after providing for debenture and other interest there remained a debit balance of £4,909. From this was to be deducted £1,252, the amount brought forward from the previous year, leaving a debit balance of £3,657 to carry forward. Connections to the company's system showed an increase of 9,744 H.P., and an additional 3,500 H.P. had been contracted for. The extension of the mains system from North Bank, River Tees, to Murton had been completed, and the company's system in the Tees district had been connected up with that of the Newcastle and Durham County Distribution Companies on Tyneside.

Stock Exchange Notice.—Application has been made to the Committee to allow the following security to be quoted in the Official List:—Rosario Electric Co.—Further issue of 2,553 6 per cent. cumulative second preference shares of £5 each fully paid.

Official Announcement re Companies.—The following are to be struck off the register in three months, unless cause is shown to the contrary:—

Chitty Dynamo and Motor Co., Ltd.
French Victoria Accumulator Co., Ltd.
Gutta-Percha Corporation, Ltd.
H. M. Salmony & Co., Ltd.
Phœbus Solder and Electric Soldering Fluid Co., Ltd.
Premier Electric Lamp Syndicate, Ltd.
Smokeless Chimney Co., Ltd. (Registered July 21st, 1899.)
Special Telephone Directories, Ltd.
Steam Boilers Circulators' Co., Ltd.
Warrington and District Electric Light and Power Co., Ltd.

Mexican Light and Power Co.—A dividend has been declared of 3½ per cent. on the preference shares for the six months ending October 31st.

Mexico Tramways Co.—A dividend of 1½ per cent. is announced for the quarter ended September 30th.

The American Westinghouse Co.—According to the *Electrical World* the Westinghouse Electric and Manufacturing Co., on September 29th, announced that regular dividends upon the preferred stock would be resumed, and declared a quarterly dividend at that time of 1¾ per cent. There was also declared a dividend of 3½ per cent. on account of the accumulations overdue since October, 1907, upon the preferred stock. This stock is entitled to 7 per cent. per annum cumulative, and 12¼ per cent. back dividends were due. There is outstanding $3,998,700 of this preferred stock. "No information has been given out as to how soon the earnings of the company will permit a dividend upon the assenting stock, of which $56,000,000 is authorised and $37,000,000 is outstanding. It is believed that the back dividends upon the preferred stock will be entirely liquidated before the other matter is taken up. The Westinghouse concern announces a very satisfactory expansion in business, sufficient working capital, and altogether a very good financial standing."

Bank Rate.—The Bank Rate was yesterday raised from 4 to 5 per cent.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Oct. 13	2,740	— 87	19	29,426	— 608	..	..
Ayr	„ 16	421	— 30	22	8,527	— 103	8	..
Bath	„ 16	1,569	— 94	41	32,340	+ 1,350	..	..
Belfast	„ 15	7,833	+ 214	27	109,625	+ 4,614	37	..
Birkenhead	„ 17	2,106	+ 2	28	31,082	— 398	13·63	..
Birmingham Corp.	„ 9	13,831	+ 689	28	181,459	+ 4,611	56·5	..
Blackburn	„ 13	2,166	— 271	29	32,814	— 1,140	13·97	..
Blackpool-Fleetw'd	„ 16	858	— 299	15	19,740	+ 921	..	..
Bolton	„ 17	4,745	+ 137	29	68,641	— 201	26	..
Bournemouth	„ 13	3,169	— 16	28	51,241	+ 207	21·96	..
Bradford	„ 9	9,926	— 15	27	137,333	+ 3,568	54·81	..
Brighton	„ 17	1,899	+ 31	29	30,616	+ 1,358	9·5	..
Bristol	„ 15	11,354	+ 736	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 8	475	+ 2	40	8,792	— 80	3·65	..
Barnsley	„ 8	337	— 27	„	6,767	— 356	..	..
Barrow	„ 8	467	— 39	„	9,416	— 653	5·37	..
Cavehill	„ 8	177	+ 1	„	3,630	— 78	..	..
Devonport	„ 8	746	— 298	„	14,860	— 3,822	8·85	..
Gateshead	„ 8	2,033	— 60	„	39,916	— 503	11·25	..
Gravesend	„ 8	458	— 13	„	8,541	— 113	6·5	..
Greenock	„ 8	1,229	+ 160	„	22,548	+ 1,177	7·25	..
Hartlepool	„ 8	496	— 18	„	9,557	— 205	6·72	..
Kidderminster	„ 8	205	— 6	„	4,457	— 178	..	..
Leamington	„ 8	387	+ 2	„	7,197	+ 250	..	..
Merthyr	„ 8	408	— 51	„	8,533	+ 31	2·9	..
Metropolitan	„ 8	12,923	— 232	„	250,489	+18,590	22	..
Middleton	„ 8	667	— 66	„	13,697	— 948	8·5	..
Mid. Joint Com'tee	„ 8	12,158	+ 95	„	229,210	— 2,024	..	..
Oldham—Ashton	„ 8	1,158	— 74	„	22,613	— 1,310	9·18	..
Peterborough	„ 8	313	— 40	„	4,849	— 416	5·31	..
Potteries	„ 8	3,790	+ 95	„	71,384	— 1,002	29	..
Rothesay	„ 8	279	..	„	9,517	+ 177	2·75	..
Southport	„ 8	561	— 66	„	11,932	— 341	8·17	..
S. Metropolitan	„ 8	1,648	— 237	„	32,454	— 534	..	..
Swansea	„ 8	2,234	+ 263	„	39,225	+ 1,104	12·5	..
Tynemouth	„ 8	445	— 43	„	10,388	+ 744	3·75	..
Weston-s Mare	„ 8	229	— 12	„	6,808	+ 393	3	..
‡Worcester	„ 8	581	— 35	„	11,889	— 163	5·75	..
Wrexham	„ 8	202	— 17	„	4,004	— 153	..	..
Yorks. Wool. Dist.	„ 8	1,969	— 25	„	36,927	— 94	17	..
Miscellaneous	„ 8	424	— 5	„	8,506	+ 135	..	..
Burnley	„ 16	2,611	+ 219	..	..	..	..	..
Burton-on-Trent	„ 17	587	+ 13	29	7,856	— 193	6·63	..
Bury	„ 17	2,437	+ 127	28½	34,625	— 471	22·5	..
Cardiff	„ 9	4,439	+ 68	28	62,942	+ 670	..	..
Carlisle	„ 16	857	— 6	41	6,919	— 327	..	..
Chatham and Dist.	„ 14	1,856	— 55	41	34,171	+ 1,573	14·98	..
Cork	„ 14	1,084	+ 60	41	18,604	— 544	9·89	..
Croydon	„ 1	3,452	+ 584	..	41,869	+ 2,665	11·25	4·75
Darlington	„ 16	387	— 20	29	5,406	— 400	..	..
Darwen	„ 15	511	— 4	28	7,190	— 205	4·86	..
Dover	„ 9	427	— 30	28	6,394	— 428	4·75	..
Dublin	„ 15	10,974	+ 192	..	89,518	— 1,574	54·25	..
Dundee	„ 13	2,499	— 88	21½	26,210	— 534	15	..
East Ham	„ 18	2,012	+ 111	28½	29,138	+ 3,698	8 52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	„ 16	35,621	— 711	..	336,829	— 5,153	94½	5
Hastings	„ 14	2,024	— 219	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	..	..	..	..	..	..	..	..
Ilkeson	„ 13	272	— 19	28	3,892	— 243	..	..
†Ipswich	„ 9	399	— 4	28	11,981	+ 118	10·5	..
Kilmarnock	„ 16	293	— 3	22	3,352	— 117	4·25	..
Lan'kshire Trm. Co.	..	..	..	..	..	..	..	..
Lancashire United	„ 13	2,583	— 278	41	54,791	— 744	39	..
Leeds	„ 9	13,891	+ 48	28	190,978	+ 4,101	54	6
Leicester	„ 16	4,828	+ 16	..	..	..	..	..
Leith	„ 9	1,232	+ 91	21	13,580	+ 1,734	9	8
†Liverpool	„ 2	11,158	— 285	39½	422,058	— 2,122	58·5	..
‡L.C.C.	„ 2	77,924	+2,454	..	974,119	+36,151	124·7	2·375
London United	„ 16	11,910	—2,193	..	254,171	—27,427	..	..
Lowestoft	„ 16	286	— 18	3	448	— 22	3·5	..
Manchester	„ 16	30,399	—1,501	29	435,205	— 4,697	105	..
Newcastle	„ 16	7,964	+ 173	..	111,540	— 1,897	..	..
Newport	„ 9	1,340	— 1	27	18,709	— 311	14·5	..
†Oldham	„ 10	1,878	+ 42	28	53,662	— 3,747	28·75	..
†Pontypridd	„ 9	410	— 16	27½	11,616	+ 1,014	5·5	1·75
Portsmouth	„ 16	8,900	— 124	29	64,733	+ 1,798	14·5	·75
Preston	„ 13	1,513	+ 32	..	..	..	..	..
Rotherham	„ 14	1,169	— 86	28	16,768	— 849	10	·66
Salford	„ 11	9,195	— 659	27½	128,968	— 3,985	..	..
Sheffield	„ 17	11,984	+ 796	29½	166,268	— 209	39·62	2·6
Southampton	„ 13	2,181	— 5	28	31,318	— 427	..	..
Southend-on-Sea	„ 13	950	+ 28	29	17,006	+ 2,350	..	..
South Shields	„ 16	1,115	— 6	28½	16,569	— 81	..	..
†Swindon	..	..	..	..	..	..	..	..
Tyneside	„ 13	815	— 41	15	6,763	+ 236	..	..
Wallasey	„ 16	1,802	+ 11	28½	27,643	+ 700	..	·22
Walthamstow	„ 16	1,283	— 9	29	19,894	+ 286	9	..
West Ham	„ 9	4,708	+ 94	27	64,955	+ 3,977	15·13	·43
Wolverhampton	„ 13	1,914	+ 193	28	28,528	— 503	14·25	1·75
Baker St.-Waterloo	„ 16	6,585	+ 270	15	44 610	+ 200	4·25	..
Cen. London Rly.	„ 16	11,126	—5,839	15	75,829	—37,272	6·32	·55
Char. & Rus. Hamp.	„ 16	7,610	+ 745	15	54,940	+ 5,715	7·75	..
City & S. Lon. Rly.	„ 16	6,266	+ 212	15	46,053	+ 1,498	7·3	..
Dublin-Lucan Rly.	„ 15	282	+ 12	15	2,459	+ 84	7	..
G.N. and City Rly.	„ 16	2,800	+ 10	15	19,224	— 21	3.5	..
G.N., P'y. & Brmin.	„ 16	11,155	+ 670	15	75,615	+ 1,120	9·25	..
L'pool Overh'd Rly.	„ 17	2,601	— 34	15	22,836	+ 23	6·8	4·3
Llandudno-Col. Bay	„ 15	887	— 2	46	13,441	+ 2,150	..	..
Mersey Railway	„ 18	3,879	+ 140	15	28,928	+ 1,103	4·5	..
Metropolitan Rly.	„ 17	32,633	—1,805	..	238,315	— 5,187	24·5	..
Met. District Rly.	„ 16	20,178	+ 280	15	142,853	+ 5,731	24	..
Anglo-Argentine	„ 14	83,516	+5,332	..	1,605,110	+98,062	..	..
§Auckland	Sept. 10	13,098	+ 195	36	122,707	+11,020	22·3	1·38
Bombay (B.E.T.)	„ 16	5,084	+ 92	37	92,819	+ 5,482	..	..
§Brisbane	„	15,800	+1,310	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 16	7,085	+1,374	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	4,269	..	..	34,534	..	20·5	..
Madras	Oct. 15	1,391	+ 135	..	24,311	+ 755	..	..
§Melbourne	..	..	..	..	..	..	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	„ 15	2,712	+ 159	..	57,361	+ 632	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Various causes—of which money is the principal—conspire to hinder the course of free business in Stock Exchange markets, and the markets generally have fallen into a sort of jog-trot condition. There are spasmodic gasps of strength in the Home Railway market, and there is a good deal of activity amongst rubber shares.

Prompted, no doubt, to some extent by the success of the New York Telephone issue, the Cuban Telephone Company has this week been offering £1,000,050 of 5 per cent. First Mortgage Convertible bonds at 92. It cannot be said, however, that this was received with a superabundant amount of enthusiasm, and before the lists closed the price was quoted "round about par"—*i.e.*, 92—in the market. The New York Telephone scrip commands a premium of 3 for cash, and ¼ more for special settlement.

The breath of improvement in Home Railway prices has not electrified any of the quotations with which these paragraphs are more particularly concerned. Indeed, Metropolitan Consolidated has sagged away, and Districts, too, are down after their rise of last week. The company's 6 per cent. Debenture stock fell 2, to 142, and, in view of the manifestly improving fortunes of the company, this security may be worth notice by the investor, yielding, as it does, 4¼ per cent. on the money at the present price, and with dividends due in January and July.

Baker Street and Waterloo 4 per cent. Debenture changed hands at 99¾ on Monday, Charing Cross and Euston Fours at 96 and Piccadilly Debenture at 96⅝ on the same day. Piccadilly 4 per cent. Preference stand at 8¼, at which the return is a trifle under 5 per cent. on the money. The Brighton Railway's electrified portion is expected to be open for traffic on December 1st next.

The feature in the rubber market is the amazing rapidity with which prospectuses of new issues continue to be poured out, practically every day bringing one or more fresh undertakings to the attention of the public. Somewhat a novelty is the offer at 2s. per share of 250,000 Nilambur Rubber Estates shares of 3s. each, with 1s. 6d. paid up. The offer is made by the London Financial Trust, and the shares are available in respect of an option to subscribe for shares which was granted at the time the company was registered.

After a sharp shake out of weaker holders, the rubber share market has hardened up again, and prices exhibit a quiet amount of steadiness which will, if maintained, serve a more excellent public purpose than all the wild gyrations, slumps and booms that have attended the rubber market throughout the current year.

Some of the authorities in the electric lighting companies aver that the famine price of rubber, the raw material, will make little perceptible difference in the expenditure, although, of course, it must exercise a certain influence. The outlook for the electricity supply prices is rendered none the rosier for the rise in rubber, but then people have ceased to take any particular interest in these descriptions. The price-lists overleaf show no alterations amongst the Metropolitan shares. In Bromptons the fall has been stayed; perhaps certain strong representations from the Stock Exchange helped to check the drop, but the prices are still flat. Hove shares have come down 7s. 6d., of which 4s. is due to the *ex* dividend marking. River Plates continue to ascend; the Ordinary are now up to 1⅝ middle.

The Mexico-Canada group is quieter than usual. Mexico Trams are unchanged, and Rio Trams at 93 are *ex* a dollar dividend. The 5 per cent. first mortgage gold bonds at 95 and the 5 per cent. mortgage bonds at 85 show very little change. British Columbia Electric Railway stocks are very strong. The Deferred is up 7 and the Preferred 1.

British Electric Tractions are quoted nominally a trifle easier, but the First Debenture is again the turn harder, and the Preference shares are ⅛ better.

In the Telegraph department the few alterations are mostly due to the deduction of dividends. Anglo-American Deferred is, perhaps, the strongest feature. Direct United States shares recovered part of their dividend, Eastern Extensions the whole of theirs. Marconi shares are dullish, and in the Trust group nothing noticeable has happened. Telephone issues are steady. United River Plate Ordinary have gone over 7, and Monte Videos are better by a shade.

Babcock Preference gained ⅛. So did British Westinghouse Preference: those fully-paid shares of £5, which stand at 7s. 6d. Cromptons and Ediswan partly-paid shares are rather lower.

Montreal Light, Heat and Power Co.—A dividend of 1¾ per cent., at the rate of 7 per cent. per annum, for the past quarter, is announced.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations Oct. 12th.	Closing Quotations Oct. 19th.	Business done week ended Oct. 19th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3 — 3½	3 — 3½	..	..	..	£ s. d. Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	94 — 97	95 — 98	..	..	+1	5 2 0
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7⅜ %	8 %	8 %	8 %	145 —147	145 —147	..	..	..	5 8 10
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 93	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	32½ %	35½ %	34½ %	£3 4s.	61½ - 63½	61 — 63	..	..	— ½	5 3 2
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	102 —103	102⅝	101	—3	5 16 6
3,220,770	Do. do. do. Deferred	Stock	½ %	1½ %	1 %	8/-	20⅞— 21⅛	21⅞— 21	22	20½	..	1 17 10
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	102½	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 9⅛	8 — 8⅝	..	..	..	4 14 1
2,431,350	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	88 — 90 xd.	89 — 90	89½	88½	..	4 8 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅜ — 9⅜	8⅜ — 9⅜	9½	..	..	6 8 0
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½ — 18½	17½ — 18½	..	..	..	5 8 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½ %	4½ %	4½ %	4½ %	100½ -102½	100½ -102½	..	..	..	2 3 11
60,710	Direct United States Cable	20	4½ %	4½ %	4½ %	4½ %	13½ — 13⅝	13⅝ — 13⅝	13⅝	..	+ ⅛	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —132	127 —130	130	127½	—2	5 7 8
2,000,000	Do. 5½ % Pref. Stock..	100	5½ %	5½ %	5½ %	5½ %	85 — 87	84 — 86	85⅝	84½	—1	4 0 11
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104 —106	104½—106½	105⅛	104½	+ ⅛	3 15 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅜ — 12½	11⅜ — 12½	12 3/16	11⅜	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	108⅜	102	..	3 16 11
900,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½ %	5½ %	5½ %	5⅜ %	10½ — 10⅝	10½ — 10⅝	10 7/16	..	..	5 8 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅜ — 14⅜	13⅜ — 14⅜	18⅜	13 17/32	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26½ — 27½	26 1/16	26⅜	+ ⅛	6 10 11
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	52	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½ %	4 %	4 %	93 — 96	93 — 95	93⅜	..	— ½	4 4 3
$60,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	75 — 78	77 — 79	77	..	+1½	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅝ — ¾	⅝ — ¾	..	..	..	N'l
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅝ — ¾	¾ — ⅞	..	..	+ 1/16	6 17 2
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝ — ¾	¾ — ⅞	..	..	..	5 14 3
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ —108	107 - 108½	107	..	+ ⅜	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	121 —123	122	121	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¾ — 11	10¾ — 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16 — 5 1/8	5 1/16 — 5 1/8	5 1/16	..	..	4 7 8
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½ %	5½ %	5½ %	5½ %	98 — 100	98 —100	98½	97½	..	5 10 0
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅛	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 3/32 — 1 1/32	1 3/32 — 1 1/32	30/-	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86⅜ — 88½	86½	..	+ ½	4 10 5
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅜ — 8¼	7⅜ — 8¼	..	..	— ⅛	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ -102½	100½ -102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	131 —134	129 —132	..	..	—2	4 10 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6¾ — 7⅛	7 — 7½	7½	7 1/16	+ ⅛	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	+ 1/16	4 18 9
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1 7/16 — 1 1/8	1 7/16 — 1 1/8	..	..	..	3 15 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13½ — 14	13½ — 14	13⅝	13 1/16	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1⅛ — 1⅜	1⅛ — 1⅜	15/7½	14/-	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8½ — 9½	8½ — 9½	9	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 8	15 %	8½ — 9½	8½ — 9⅝	9⅛	..	..	15 15 10
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½ -103½	101½ -103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅜— 4⅞	4⅜— 4⅞	96/3	93/1½	..	5 2
500,000	Do. 5 % 2nd Pref., 800,001 to 1,800,000	5	..	..	..	..	4 7/16— 4 11/16	4 7/16— 4 11/16	..	..	..	5 6
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	92½ — 93½	92 —93	93	92½	— ½	4 6
332,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
680,000	Babcock & Wilcox, 1 to 680,000	1	20 %	20 %	20 %	20 %	4⅜ — 4½	4 7/16 — 4 9/16	90/-	88/9	+ 1/16	4 7 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1 3/16 — 1 5/16	..	..	+ 1/16	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	¾ — 1	¾ — 1	..	..	..	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	6 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½ %	5½ %	5½ %	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	151 —166	151½	148	+7	5 2 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —125	121 —126	122	..	+1	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	111½	110½	..	4 9 3
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	100 —102	..	..	—2	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	3 %	Nil	Nil	Nil	⅜ — 1	⅜ — 1	15/7½	15/-	— 1/16	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	12½%	2 — 2½	2⅛ — 2⅝	46/-	45/-	+ ⅛	6 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	82 — 85	82½ — 85½	84	83½	+ ½	5 9 1
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	62 — 66	62 — 66	..	..	..	5 17 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7½ — 7⅝	7½ — 7⅝	..	..	..	5 10 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅝ — 6¾	6⅝ — 6¾	..	..	..	4 11 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 — 106	..	..	..	4 4 11
304,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 7/16	⅜ — ½	..	..	+ 1/16	Nil
1,916,853	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 — 42	40 — 43	..	..	+1	9 6 0
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	7/16 — 9/16	7/16 — 9/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅜ — 5¼	4⅜ — 5¼	..	..	— ⅛	4 7 10
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,830..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —103	101 —104	103⅜	..	+1	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜ — 11⅛	10⅜ — 11⅛	10⅛	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 6⅛	5⅜ — 6⅛	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 1/16 — 2 3/16	48/-	42/3	+ 1/16	5 19 1
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	8 %	3½%	61 — 63	60 — 62	62½	60½	—1	5 4 10
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	..	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1¾%	2½%	2½%	1¾%	30½ — 31½	30 — 31	20⅞	30	— ½	4 16 9
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	5 %	⅞ — 1⅛	⅞ — 1	..	..	— ⅛	15 1 8
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 98	90 — 98	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 19th.	Closing Quotations Oct. 19th.	Business done week ended Oct. 19th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1906.	1907.	1908.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜— 13⅜	12⅜— 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½ %	4½ %	2½ %	1½ %	5/16— 3/8	5/16— 3/8	..	..	— 1/32	27 5 4
17,189	Do. "A" shares, 01—017,189 ..	5	4½ %	4½ %	2½ %	2½ %	1 — 1⅛	1 — 1⅛	..	..	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	82 — 85	82 — 85	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	7/16— 1/2	7/16— 1/2	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	7 %	1⅞— 1⅞	1⅞— 1⅞	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8½— 8¾	8½— 8¾	..	..	..	5 14 3
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87 xd	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	Nil	3/4 — 1	3/4 — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½— 10⅝	10½— 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½— 13½	12½— 13½	12⅜	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅜— 5½	5⅜— 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	106 —108	106 —108	..	..	..	4 3 4
60,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15 — 15⅝	15 — 15⅝	15 11/16	15⅝	..	6 14 3
97,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	3/8 — 1/2	3/8 — 1/2	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
800,070	London United Trams. (1901), 1 to 50,607	10	8 %	8 %	8 %	Nil	1½— 2⅛	1½— 2⅛	..	..	..	Nil
899,280	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1½— 2⅛	1½— 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3½%	2½— 2⅝	2½— 2⅝	51/3	51/-	..	13 12 8
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2½%	1	1½%	½%	38½ — 38⅞	37⅜— 38⅛	38⅜	37⅜	— ⅛	1 6 2
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	65 — 67	65 —67	..	..	..	4 9 1
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	16½— 16⅝	16½— 17	16⅞	16½	+ ⅛	Nil
201,227	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	1/16— 3/16	1/16— 3/16	13/-	..	+ 3/32	6 10 11
314,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/16— 3/16	1/16— 3/16	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	7/32— 9/32	7/32— 9/32	..	..	+ 3/32	6 7 0
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½ — 96½	94½ — 96½	96	..	..	4 13 3
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	127 —130	127 —130	128½	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	92 — 94	92 — 94	93	92	..	5 6 5
345,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	3/8— 1/2	3/8— 1/2	..	..	..	..
345,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/8— 1/2	3/8— 1/2	..	..	..	6 17 11
345,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	86½	86	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	34⅞	34 2/16	..	5 0 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	102½—103½	102½—103½	103⅜	103½	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88	87	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	33 — 35	32 — 34	34	32½	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	3/8— 1/2	3/8— 1/2	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2½ — 2⅝	2 — 2⅛	45/-	40/-	— ½	2 8 0
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 2
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6⅝ — 7⅛	6⅝ — 7⅛	7⅜	..	..	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 13 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	5 11 1
80,000	Do. do. 4⅛ % Cum. Pref.	5	4⅛%	4⅛%	4⅛%	4⅛%	4⅜ — 4⅝	4⅜ — 4⅝	87/6	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	..	..	..	5 5 11
445,786	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3¾— 4	3¾— 4	..	..	..	5 12 6
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜— 10⅞	10⅜— 10⅞	11	10⅜	..	5 10 4
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅜	11⅞ — 12⅜	12½	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	..	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1⅝— 2	1⅝— 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅝— 3⅛	2⅝— 3⅛	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½— 95½	93½— 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝— 8⅛	7⅝— 8⅛	..	..	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 11⅛	10⅝— 11⅛	10⅝	10⅜	..	5 7 10
400,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	104 —107	104 —107	106	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	58	57⅛	..	7 10 0
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅞	4⅜— 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	4 13 9
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞— 7⅞	6⅞— 7⅛	6⅛	6⅞	— ⅛	5 17 3
$1,875,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	99 —101	100⅜	..	..	4 19 9
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞— 2⅛	1⅞— 2⅛	41/3	..	..	4 16 0
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	5 — 5⅛	4⅞— 5⅛	..	..	— 1/16	5 14 3
882,856	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
300,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5	4⅝— 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
348,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½— 86½	83½— 86½	82⅞	82	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	82 — 84	82 — 84	..	..	..	5 19 1
19,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	73 — 77	72 — 76	73⅛	72⅝	—1	4 12 1
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	104 —108	105 —109	106⅝	105⅛	+1	6 8 5
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	86 — 88	86 — 88	86⅛	86	..	5 13 8
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 — 100	97 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..	2 14 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	4 15 3
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	99 — 101	..	..	—1	..
10,863	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½— 13½	12½— 13½	..	..	..	5 6
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	..	..	..	5 7 8
80,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1⅛— 1⅛	1⅛ — 1⅛	31/-	..	+ 1/32	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	22/6	..	..	5 1 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8½— 9	8½— 9	..	..	..	6 7 0
99,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	5 11 1
150,000	Do. do. 5½ % Deb. Stock Red. ..	100	5 %	5½%	5½%	5½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16— 3/8	5/16— 3/8	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛— 1 1/16	1⅛— 1 1/16	23/14	..	..	5 17 11
294,590	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	103—105	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	3/16— 7/32	3/16— 7/32	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	32/6	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74⅛— 78⅛	74⅛ — 78⅛	76⅛	75⅛	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000 ..	1	..	..	..	5 %	15/16— 1	15/16— 1	19/6	19/3	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8⅞— 9	8⅞— 9	..	..	..	5 11 1
81,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 3 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 4 per cent.. October 14th, 1909.

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

(*Continued from page* 608.)

Effects of Telluric Currents on Cable-Break Localisation.

The writer has already referred to the possibility of localisation tests having to be made on a cable from which a strong *positive* current is found to be flowing. Allusion is not here made to the ordinary *positive* current due solely to the copper-iron couple at the break, but to a much stronger current produced, may be, by abnormal terrestrial magnetic conditions which have caused a strong telluric current of one sign or another to flow from the testing end of a broken cable.

Under normal conditions the application of the usual *negative* testing current causes the current of *positive* sign due to the copper-iron couple at the break to be, as it were, swamped, and the copper polarised in such a manner as to

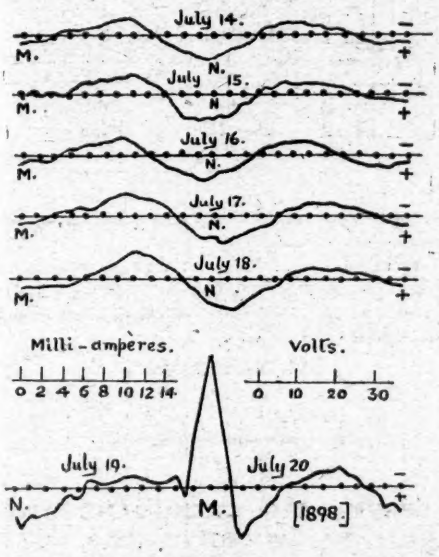


Fig. 47.

give a current from the break in a *reverse* direction, that is to say, of negative sign.

Clearly, under these normal conditions, the ordinary testing routine with negative currents of various strengths would give the usual results according to the Kennelly or the Schaefer law, under which conditions, the higher the testing current used, the lower would be the apparent resistance at the break, and *vice versa*.

If, however, the *negative* polarisation current be swamped by a strong telluric current of *positive* sign, the normal fall of bridge balances obtained on a cable will be completely altered, and it may be that with normal testing currents zinc to line, the higher battery powers will be found to produce the higher bridge readings, and the lower powers the lower bridge readings, with consequent necessity for re-sorting to a carbon testing current. This is a somewhat involved question, and one that the writer would wish to see thoroughly dealt with in future editions of existing excellent text-books on submarine cable electrical tests.

Exact knowledge of actual conditions regarding the resultant testing current passing into a cable influenced by a strong telluric current one way or another is given by a mil-ammeter between the other apparatus and the cable. The mil-ammeter has, of course, long since been reckoned indispensable for cable-break localisation purposes.

Fig. 47 shows a few out of many days' telluric current observations made at Cape Cod in July, 1898, under the direction of the writer on a length of 1,562 nautical miles of Atlantic cable—core 660 Cu/400 G.P. per N.M.—making earth at the distant end, in mid-ocean. (CR = 2,637 ohms approx.) at sea temperature.

In the diagram dots mark off hours as abscissæ of the curves, while the accompanying scales of milli-amperes and volts facilitate evaluation of the curve ordinates.

Observations made July 14th to July 18th inclusive, may be taken to indicate normal telluric current conditions across the North Atlantic.*

Inspection of curves—or of the figures in the following table—for any one of the days on which earth currents were normal, July 18th, for instance, will show that at Cape Cod at 7 a.m. on that day a negative E.C. at 7 volts P.D. (*a*) flowed from the cable, whereas later on, at 1.30 p.m., the E.C. was at a P.D. of 8 volts *positive* (*b*).

Towards eleven o'clock on the night of July 19th a "magnetic storm" gave signs of approach, and is found duly recorded in the portion of the curves for July 19th and 20th, given in fig. 47 with midnight instead of noon in the centre of the horizontal time-line, so that the configuration of this telluric disturbance may be more clearly shown. The main feature of this disturbance is seen to be the 33-volt peak *negative* (*c*) covering over two hours, followed by a back swing peak of a maximum 13 volts positive (*d*) abnormal variation. This disturbance subsequently was proved to have synchronised with similar abnormal variation photographically recorded on the horizontal force and declination magnetometers at Greenwich, Kew, Stonyhurst and Paris. Here, then, are four instances, viz., *a*, *b*, *c*, *d*, where, had a localisation test been undertaken, E.C. conditions would have been found somewhat diversified. The column giving effective milli-amperes under normal bridge conditions (ratio = 1,000 : 1,000) affords evidence of what contrary E.C. conditions may be met with at various times by a cable electrician on his starting to localise a break.

Instances.	Date (1898).	Time, New York.	Earth current (E.C.). Volts. +	Volts. −	Milli-amps.	Effective milli-amps. under normal bridge conditions.
(*a*)	July 18	7.0 a.m.	—	7	2·7	2·1
(*b*)	" "	1.30 p.m.	8	—	3·0	2·4
(*c*)	" 19/20	midn't.	—	33	12·5	10·1
(*d*)	" 20	2.0 a.m.	13	—	4·9	4·1

The figures in the foregoing table do not, of course, exactly give telluric current values, seeing that these must necessarily be affected by the slight voltage pertaining to the natural battery (Fe — Cu) couple at the cable break. In fact, the natural positive current from the battery couple at the break must itself be modified in the presence of a much more powerful telluric current which must necessarily polarise the exposed copper at the break one way or another, additional complications and reactions thus arising in any true analysis of what really takes place at the break, and so—*ad infinitum!*

Graph Proofs of Cable-break Test Conditions.

Here follow graph proofs by the writer illustrative of the foregoing remarks on the *Polarity of Test Currents*.

In figs. 48 and 49, the galvanometer used on the bridge is taken—for simplicity of illustration—as being like an electrometer, or on a circuit of practically infinitely high resistance, as through a condenser. The inward or outward deviation of the lines of potential-fall at points coinciding with G_1 and G_2 is thereby avoided, and the diagram simplified.

Fig. 48 shows test conditions at moment of application of *positive* or *negative* testing P.D.'s to a cable already affected by a natural *positive* P.D. at the break.

If from any cause—such, for instance, as a strong *positive* telluric current—the natural P.D. at the break is maintained *positive*, then fig. 48 shows how, when this is so, dual tests to scale zero with *negative* currents must necessarily be useless, as the higher testing current neg. C_2 produces the higher apparent resistance T_1, as read on the bridge at t_1.

* See article on "Atlantic Earth Currents." By E. Raymond-Barker. Electrical Review, May 4th, 1899.

whilst the lower current neg. C_1 produces the lower apparent resistance T_2 as read upon the bridge at t_2.

On the other hand—as shown by fig. 48—a dual test with *positive* current becomes effective and affords rational results. Here the higher of the two currents, pos. C_2 is seen to be productive of the lower apparent resistance T_3 indicated by the bridge reading t_3, whilst the lower current pos. C_1 brings about the higher apparent resistance T_4, as shown by the higher bridge reading t_4.

Fig. 49 shows a reversed, and what might be termed the orthodox condition of things, viz., that state of affairs that the cable electrician expects to find when he starts to localise a cable break. Here, the application of *negative* testing P.D.'s has polarised the exposed copper at the break so that the former weak positive Cu — Fe battery-couple P.D. has become reversed to *negative*. This negative P.D. at the break now opposes the *negative* testing P.D.'s, so that—contrary to the conditions existing in the former fig. 48—the higher and lower P.D.'s, viz., neg. C_2 and neg. C_1 respectively

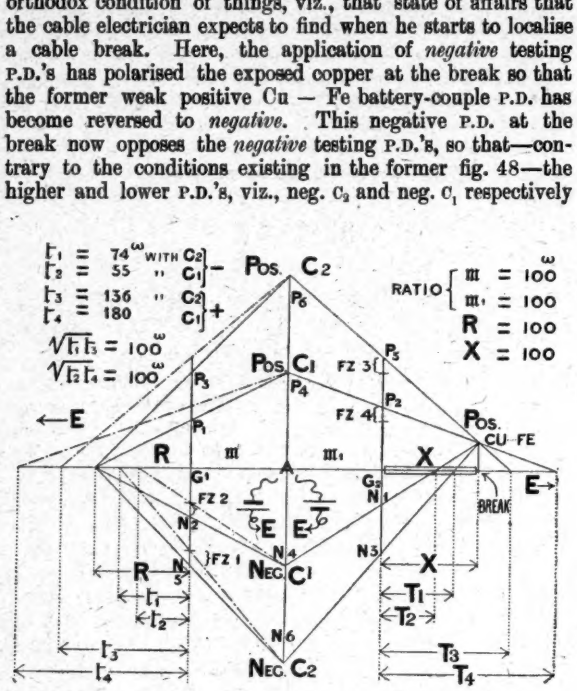


FIG. 48.

bring about lower and higher apparent resistances T_1 and T_2, as observed at the corresponding bridge balancing resistances t_1 and t_2.

A similar state of affairs as regards polarity of P.D. would prevail—though to a greater degree—in the event of a strong *negative* telluric current flowing, so to speak, from the break towards the testing station, opposing, therefore, any applied testing current of *negative* sign, for well-known reasons, the right polarity to test with whenever practicable.

Fig. 48 and fig. 49 include graph illustration of so many other points connected with Wheatstone bridge tests on cables traversed by earth currents, that some additional interpretation may here be given.

Bridge ratio resistances $m = m_1 =$ (say) 100^ω. Balancing resistances R = cable X = 100^ω respectively to earth at E, and at break.

To bridge apex A may be applied higher and lower battery powers of either sign, viz. : Neg. C_2, C_1, or pos. C_2, C_1, these severally producing at various easily recognisable points potentials N_1 —— N_6, and P_1 —— P_6.

T_1 and T_2 = observed resistances of cable by bridge readings (to scale zero) t_1 and t_2 under *negative* testing currents.

T_3 and T_4 = observed resistances of cable by bridge readings (to scale zero) t_3 and t_4 under *positive* testing currents.

R, m, m_1, and X each being = 100^ω, linear measurement of the various balancing resistances t_1, t_2, t_3, t_4, will show that by construction in, say, fig. 48 :—

$t_1 = 74^\omega$ under higher power *negative*,
$t_3 = 136^\omega$ " " " *positive*.

Then $X = \sqrt{74 \times 136} = 100^\omega$ the correct C R of cable here obtained by Dressing's geometrical mean.*

* First published in the TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW, November 15th, 1877.

Again, in fig. 48 by construction, the linear measurement :—

$t_2 = 55^\omega$ under lower power *negative*,
$t_4 = 180^\omega$ " " " *positive*.

Then $X = \sqrt{55 \times 136} = 100^\omega$ the correct C R of cable by Dressing's geometrical mean. This mention of the geometrical mean has, of course, no practical bearing on tests to a break. It is merely illustrative of the comprehensiveness of graphs, figs. 48 and 49.

Reasoning similar to the above applies also to the extracting of parallel values from fig. 49, but in the reverse order,

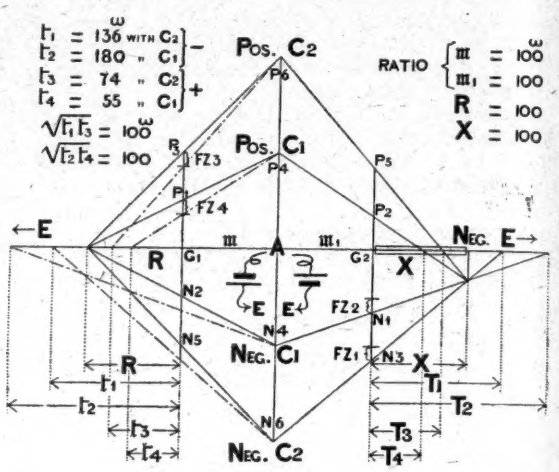


FIG. 49.

owing to the E.C. potential in that graph being *negative* instead of *positive*.

The bracketed values FZ_1 . . . . FZ_4 show, each in its place, that excess of potential on one side of a balance, to which is due the galvanometer deflection, constituting what is known as *false* or *cable* zero.

(*To be continued.*)

THE SYSTEMATIC FILING AND STORING OF RECORD CHARTS.

BY CRITICUS.

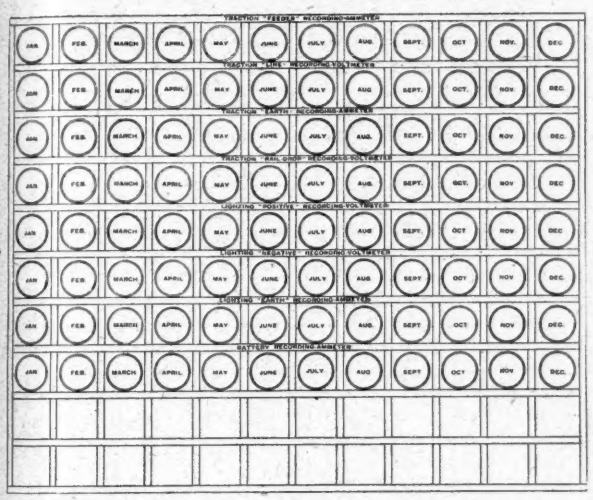
THE question of filing and storing of record charts is an important one, and yet it is safe to say that very few central stations can boast of a really good system. A well-appointed drawing office affords a good example as to what should obtain in this particular department ; here, a few seconds' time is usually sufficient for the production from store of a drawing, print, &c., and there is no reason why even the small-sized stations should not possess an equally satisfactory system at a minimum of first cost and subsequent upkeep.

The usual method, where any attempt at all is made for the systematic filing of records, is to use an ordinary letter file, or some modification thereof. But this arrangement soon becomes unwieldy, as, even where only two or three recording instruments are kept, as in the case of, say, a small lighting station, the record charts quickly accumulate, and if additional files are not used for storing—which means further cost—the charts are generally removed from the files and rolled up in the form of bundles, to be finally packed away anyhow in some out-of-the-way hole or corner. There they remain out of sight, and likely enough out of mind as well, until, perhaps, some day a certain record is urgently wanted for reference—maybe at a Board of Trade inquiry. A day or two's exciting search having proved unavailing, the record wanted is considered lost. Although the Board of Trade Regulations provide that certain records relating to the operation of public supply systems must be kept, yet in

practice the requirements are often more honoured in the breach than in the observance.

It seems somewhat strange that most recording instruments for electrical purposes are by no means satisfactory when working under every-day conditions; and it is no exaggeration to say that, in the majority of cases, the inking arrangements give most trouble. An instrument suitable for a widely-varying load, say a recording ammeter for heavy traction load, which will print a true and legible record without constant attention, has yet to be seen by the writer, who speaks from extensive experience. This may seem to be digressing somewhat from the foregoing subject, but, making due allowance for the human element, the more imperfect the record the less chance it stands of ever being permanently filed.

As mentioned before, it is only in the larger stations that anything like system is observed in the filing and storing of records, and here it is usual for the drawing office staff to look after this particular department. But where no drawing


TRACTION "FEEDER" RECORDING AMMETER
TRACTION "LINE" RECORDING VOLTMETER
TRACTION "EARTH" RECORDING AMMETER
TRACTION "RAIL DROP" RECORDING VOLTMETER
LIGHTING "POSITIVE" RECORDING VOLTMETER
LIGHTING "NEGATIVE" RECORDING VOLTMETER
LIGHTING "EARTH" RECORDING AMMETER
BATTERY RECORDING AMMETER
JAN. FEB. MARCH APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

Systematic Filing and Storing of Record Charts.

office facilities are available, as in the case of most small stations, chaos soon reigns, and it is astonishing what a litter a few months' accumulation of record charts becomes.

With a view of assisting those who may be thus placed, the writer some time ago devised the arrangement described herewith.

A simple arrangement of shelves is fitted up and pigeon-holed. The size of each compartment should be about 6 in. × 3 in. × 3 in. For containing the record charts cylindrical-shaped papier-maché boxes with well-fitting lids are used. The type of box employed for phonograph records is well suited for the purpose in question, and these can be obtained complete with neat labels, any colour, at very reasonable cost.

The accompanying sketch, which is really self-explanatory, illustrates the device arranged for ten recorders, the two bottom sets being meant for spares for possible future extensions. The writer has taken an example fairly representative of a moderate-sized combined lighting and traction supply station, the recording instruments being as follows:—

Traction "Feeder" Recording-Ammeter.
Traction "Line" Recording-Voltmeter.
Traction "Earth" Recording-Ammeter.
Traction "Rail-Drop" Recording-Voltmeter.
Lighting "Positive" Recording-Voltmeter.
Lighting "Negative" Recording-Voltmeter.
Lighting "Earth" Recording-Ammeter.
Battery Recording-Ammeter.

The usual monthly files are, of course, used in conjunction with the device. At the end of the month, however, the file is stripped, and the record charts, after being secured together in proper sequence of dates by means of one or two substantial fasteners (strong bifurcated pins are very suitable), are transferred to the storing box, correctly labelled, and finally pigeon-holed. The subsequent storing of the records will, in individual cases, be largely governed by local circumstances. It will be seen, however, that the device illustrated is well adapted for extension to accommodate several years' accumulation of record charts, and practically without materially adding to its bulk, except to slightly increase the depth or back to front dimensions.

The arrangement is simplicity itself, and its first cost and subsequent upkeep trifling, and by its means any record can be produced at a moment's notice. It will be fairly obvious that if appearance be a desideratum, the rack can easily be made to match superior surroundings, by the aid of stain and varnish, with perhaps the added dignity of doors, glazed or plain, or some form of collapsible shutter to exclude dust and dirt.

REVIEWS.

Electric Railways Theoretically and Practically Treated. Vol. II. By Sidney W. Ashe, B.S., E.E. London: Archibald Constable & Co. 10s. 6d. net.

This is the second part of a proposed three-volume work on electric railways, and deals particularly with engineering preliminaries and direct-current sub-stations. It is an American production, so that the word "railway" must be understood as including tramways, and particularly the interurban lines which are so characteristic a feature of American electric railway development.

The book is professedly a text-book of the subject rather than a treatise, so that one cannot complain that it is, to a large extent, a compilation from the papers of experts, interspersed with descriptions of standard apparatus and methods of operation, illustrated with such pictures as manufacturers of apparatus are always willing to supply. The result is, on the whole, satisfactory, and the book will be of value to students seeking general knowledge of the subject. The methods described are sound, and the information is fairly up to date.

Chapter I deals with the estimation of profits of a prospective line from a counting of noses in the vicinity. Much more experience is required in the estimation than the simple tale would lead one to suppose, and the results when obtained are usually better forgotten when the line has been built. The chapter should be regarded as furnishing aid to shrewd guessing rather than a complete scientific method.

The two following chapters deal with the determination of the motor capacity; the fourth with schedules and load diagrams; the fifth with power-house and sub-station location. The remaining five chapters give descriptions of sub-stations and their contained apparatus.

The author is, perhaps, rather apt to divagate into by-ways having but slight connection with the subject in hand. One of the ten chapters, for instance, is devoted to insulating oils, being based on articles published in the *Electrical Club Journal*. So practical a discussion of the subject would adorn a work on transformer design, but appears hardly necessary here.

The book is well printed and illustrated with numerous curves, diagrams, and cuts. Fig. 86, indicating that a rotary should be up-ended in order to sandpaper the brushes, is doubtless merely inserted sideways.

Electricity for Everybody: A Popular Handbook. By R. Borlase Matthews, Wh. Ex. London: The Electrical Press, Ltd. 1909. Price 5s.

This handbook, designed to meet the demand for information of all kinds regarding the uses of electricity, contains an extraordinary mass of data, tables and condensed notes "in infinite variety," being in great part, we believe, based upon the "Canvasser's Handbook," for which the author was recently awarded a valuable prize by the National Electric Light Association of the U.S.A. The contents deal with electric lighting, heating and power, general electrical engineering notes for users of a public supply, and hints to canvassers, each division being further sub-divided into portions relating to residences, "stores," and factories. It is not

a book to be read through from cover to cover; it is rather a pocket companion for the commercial engineer or canvasser, furnishing information on, we should think, almost every point that could be raised by a prospective consumer, while to the latter it will serve to show what electricity can do for him, how it does it, why it is better than its rivals, what it costs, and how it should be used.

Naturally the advantages of electricity for lighting, and the best ways to keep the bills low, are early met with, and a model specification is given. The author deprecates references to costs per unit, strongly recommending the canvasser to discuss the total amount of the quarterly bill as a more intelligible basis. Shop lighting and advertising with electric signs are dealt with, and the use of time switches is described; the principles of illumination are clearly explained, with distribution of light curves for various arc lamps (why not for glow lamps?), and the importance of proper screening and diffusion of light is emphasised. One section is devoted to comparisons between gas and electricity for lighting and heating. The collection of data on ironing, cooking and heating will be especially welcomed, including as it does prices and costs, with other useful particulars.

In dealing with domestic applications of power, the author describes a patent "electric servant" that he has brought out, in the shape of a portable motor with a radius arm, carrying a pulley driven at reduced speed by belt from the motor spindle. The large pulley drives a friction wheel, which can be placed in contact with the driving pulley of any machine that it is desired to drive—the essence of the idea being that one motor may thus be employed to drive any number of handy domestic appliances. This is an ingenious and admirable solution of the difficulty of high cost due to the present practice of fitting every such appliance with a separate motor.

The driving of factories and workshops is the subject of a lengthy section, containing an invaluable collection of data; and the section on engineering notes covers a vast field in small space. "Hints to Canvassers" are given a separate division of the book, and constitute a liberal education in the gentle art of fishing for new business.

Not the least interesting part of the work is the series of illustrations at the end, giving examples of fittings, accessories, installations, signs, lamps, heating and cooking appliances, and power applications of all sorts. We feel that this unique handbook, in the hands of the customer, will do a great deal to broaden his—and her—views as to the possibilities of electricity in connection with his comfort, his business, and his home; in the hands of the canvasser it will be a most potent weapon, guide and support; and, generally, it should exert a material influence upon the development of the electrical industries in this country.

Les Découvertes modernes en Physique. O. Manville, D.es.Sc. A. Hermann et Fils. Price 8 fr.

To many students, and those who desire to have a pretty comprehensive knowledge of the newer discoveries in electricity, together with the mathematical treatment of the subject, this book will prove extremely useful.

The work before us consists of some 450 pages, and is divided into two portions.

The former of these consists of seven chapters, in which are discussed such things as the Discharge of Electricity Through Liquids and Through Gases, Sir J. J. Thomson's Measurements of the Ratio $\frac{e}{m}$, Ionisation of Gases, Rutherford and Sir J. J. Thomson's Experiments on Electrons. The remaining chapters of this portion relate to Radio-activity and Induced Radio-activity, and a final chapter deals with the Electronic Theory of Matter, together with the Zeeman Effect.

The second portion is split up into five chapters, and is wholly theoretical. Here the student will find the mathematical theories of Gaseous and Liquid Conduction Through Gases at Low Pressures, Righi's Theories of Binary Systems, &c. The fourth chapter deals with the Theories of Metals due to Sir J. J. Thomson, Lorenz and P. Drade, as well as the Magnetic Theories of Ewing, Langwin, &c.

The final chapter discusses Maxwell's and Lorenz's theory of light, Voigt's absorption theory, the Zeeman effect and sundry other magneto-optical phenomena.

The work is extremely well provided with references where original papers, or works, are quoted from, and it is very refreshing to notice that in this, the premier branch of physics at the present time, France, Germany, and the rest of the civilised world are mainly interested spectators of the progress made by British scientists.

At present English students have the advantage of treatises on this subject written by the pioneers themselves. Nevertheless, we consider the author has written an excellent and useful book for those who have neither time nor means to consult the original treatises or papers referred to. To many this will form a valuable book of reference.

If we have any fault to find, it is that the figures are very poorly printed, and as in most Continental treatises, the index might well be greatly extended. There are also some 12 pages of notes and errata at the end of the book, which in the third edition should, if possible, be altogether eliminated.

WATER FROM ARTESIAN BORES.

By W. H. BOOTH.

In a communicated article published in the Electrical Review for April 23rd there are certain statements relative to artesian wells that are apt to mislead the reader.

The first of these is to the effect that the supply from boreholes is very unreliable. This is not the case. A borehole having been made, and its yield proved, that yield, if properly stated, may be relied upon to endure. There are high and low water levels in all wells, but the range of fluctuation varies considerably, according to the nature of the stratum. Let the upper chalk with flint be considered. Assume that each flint bed has sufficient voids in it to store 1 in. of rainfall, in conjunction with the adjoining fissures. Then ten such flint layers would store 10 in. of rainfall, and the range of high and low water level would be small. But if the lower chalk be taken into view, it has no beds of flint and few open fissures, and it is also of a more clayey or sticky nature, and a fall of 10 in. of rain absorbed might raise the water level in the wells as much as 80 ft. Recently such an area of country came under my notice, and I found that in the full season some wells were nearly 100 ft. above the drainage point of the chalk stratum, as indicated by the presence of perennial springs at certain of the lower levels. In the ordinary process of well sinking it is usual to dig down to water, and if the digging is done when the water is not at the minimum level, then, when the level does subsequently fall to a minimum, the bottom of the well is dry; I have often walked in such wells and in the lateral headings foolishly driven at a level higher than the minimum.

Thus, while the statements in the article may be correct, they do not convey a correct impression. In boring a well the water level repeatedly changes as the work progresses, rising or falling as each fresh supply vein is pierced. These rises and falls both mean the same thing, namely, a further and more copious yield. If the level rises, it means that the new supply has a natural rest level higher than the supply above it, and is able to overcome it to such an extent that, though the new supply will partially flow away by the fissures of the older supply, yet its volume is enough to raise the general level. If a fall takes place it does but show that the water previously struck is flowing away by fissures out of which more water will flow when the level is reduced by pumping. A borehole, unless lined, will always open up communication between different strata or the various water-bearing beds of the stratum cut through.

A test by pumping, combined with observation of the hydrogeological conditions, will enable a proper estimate to be arrived at of the yield to be expected. But, naturally, water cannot be drawn from the upper part of a cistern when this is half emptied. Yet this is what is often virtually

attempted. As though to obviate this difficulty, contractors will sometimes urge very unnecessary depths for boreholes. Not every borehole will yield water, but if it does, the yield will usually be permanent. But in all such work it is most important, as the work proceeds, that notes be made of the first appearance of water, of all the stratigraphical sequences and peculiarities, and of each change of water level. Such observations are sometimes made in a most perfunctory manner, and important geological facts are lost. The greater the reduction of water level by pumping, the more water can there be taken out of a borehole, always provided that the entry of any supply into the hole is below the pumped level. If it be above the pumped level, no further increase can take place. The yield of each source which is lower than the pumped level will vary as $\sqrt{h}$, where h is the amount of lowering of head. This applies also to the yield of a borehold when fed with numerous supplies, all of which would give the same rest level, and very often the yield with reduced levels is greater than the above would indicate, for the lower springs frequently give the lowest rest level, and the yield of the boring, as a whole, usually increases at a higher rate than $\sqrt{h}$.

In a depth of 605 ft., the writer has obtained three entirely different supplies of water from as many different strata. In this particular case about 200 ft. of solid clay came between the second and third water-bearing rocks, and of the three supplies obtained, the lowest water level belonged to the upper rock, and the water from the lower rocks fed the upper rocks, and only became manifest when pumped freely. Boreholes, if properly carried out under expert advice and properly utilised under the same degree of knowledge, ought not necessarily to be so very costly. There are localities where much cannot be hoped from any sort of well, and again in other localities failure is practically out of the question. Every well ought to add to the knowledge of both geology and hydro-geology, but too often the information to be obtained is altogether too unreliable to be of independent utility. Boreholes have frequently been made which were foredoomed to failure. The testing of them is worthless, they are abandoned when they ought to be continued and so played with, often, it is to be feared, from sheer ignorance rather than unworthy motives, that it has been well said, "Truth lies at the bottom of a well; the maker of the well lies at the surface."

The importance of knowing the points where water is struck may be judged from the fact that a well, not pumped below the inflow point, will yield continuously 25 per cent. more water than is usually required if it be pumped, say, 60 per cent. lower than when giving its ordinary yield. It is simply a question of $y \propto \sqrt{h}$, an expression that cannot hold good when h has reached its limit, that is, when no lowering of the well can reduce h, as when the water flows in above the pumped level.

Some wells will bear any amount of lowering of head without injury, as when they are bored in good sound rock. But it is not always good practice to draw down the water level too far. For example, in the case of the chalk where the Thanet sand overlies it, the upper surface of the chalk is often very shaky, and a great reduction of head may cause the Thanet sand to find its way into the borehole; once the well has been strained in this way, it is difficult to remedy it. Fifty feet is a conservative practice as regards lowering the head; 100 ft. is somewhat excessive.

But very many wells yield so copiously that practically no lowering of the water level takes place under the biggest draught of the pump that can be put down the borehole.

The air-lift pump will give many times the yield of the ordinary pump, but when the water is far below surface, the depth of boring is usually much in excess of that required to give the yield, and the power required to work an air lift may be double or treble that necessary to work an ordinary pump.

Still, where water must be had and the hole is small, the air lift may be the only possible pump to fill the contract as to quantity. The air-lift pump is also useful where there is sand in the borehole. Sand is sometimes yielded by boreholes in the chalk, and probably it is almost always due to bad workmanship, including insufficient lining into the chalk, or a lining badly put in so as to permit the escape of the overlying Thanet sand into the borehole. On the whole, it is a good thing that sand should ruin a pump, and it is somewhat of a bad thing that sand can be dealt with by an air-lift pump. Though it is my opinion that the settlement of St. Paul's Cathedral is due to the shrinkage of the London clay, brought about by the fact that the water level under London has been reduced to about the upper surface of the chalk, and therefore does not maintain the London clay moist and swollen—still, it is open to be argued that many years of pumping small quantities of sand from under London have let down the clay.

The natural water level of the chalk under London is, of course, above sea level, for no natural water level can be below sea level. It is only a few years ago that scores of wells in South London, in the locality of Tooting and Mitcham, overflowed some 20 ft. above surface. Hammersmith and Fulham, less recently, were areas wherein the artesian contours were above the surface.

All this is now changed by the multitude of pumped wells, and the water level all over the London basin, or, at least, in the inner area, is going steadily down a few inches annually. But with an artesian well properly constructed, and characterised or classified as to its proper yield by a man who understands the subject, it is quite wrong to say that the supply is unreliable.

The proper yield of a well is not that which can be drawn from it at its high-water level when this is considerably above the low-water level; nor is it what can be drawn from it by a brief pumping test. Again, a prolonged pumping test, such as is often prescribed, is usually a sheer waste. A true estimate of a borehole yield may usually be made in a comparatively short time at a small cost by an engineer who is able to deal with the case in a suitable manner, such manner depending on the conditions of each particular case.

There may be instances of prolonged pumping drying a bore-hole right out. This would imply the existence of a pocket, of an abnormal segregation of a small mass of rock. But such instances are so abnormal as to be practically non-existent. Pockets are, it is true, sometimes declared to have existed, and have been brought into argument to explain the failure of a well which could be much more easily explained otherwise, though, perhaps less creditably.

CENTRAL STATIONS IN TOWNS OF LESS THAN 4,000 INHABITANTS.

A PAPER on this subject was read recently by Mr. James S. Knolson before the National Electric Light Association, of Atlantic City, N.J. It is interesting not only as showing how American practice in this matter differs from ours, but also as indicating certain lines on which English engineers may gain by adopting American ideas.

The author confines his observations to small steam-driven stations, and takes as his standard a station of 100 KW. capacity with two sets. In the first place, he strongly recommends a local company with shares as widely distributed in the neighbourhood as possible, and states that such undertakings rarely owe their inception to outside capital. This, unfortunately, is uncommon in England, and, however desirable it may be, is likely to remain so in the present condition of things electrical. The author pleads strongly for careful restriction of capital outlay, and such simplicity of arrangement as will reduce the amount of skilled labour required to a minimum. His ideal engineer is a sort of working foreman, who takes some of the shifts himself, with one eye on the switchboard and the other on the boiler gauge-glass (though, unfortunately, in the plan given in the paper, this feat is rendered difficult by an intervening wall), the stoker being an inferior sort of person, presumably living on inferior pay. Floor space being unimportant, belt-driven sets are recommended, and a curve is given showing that high-speed simple engines and direct-coupled generators are about 25 per cent. more costly than high-speed simple engines and belt-driven generators. This is very astonishing, and one would very much like to know where this large additional cost comes in. Possibly this is due to using a very high-speed dynamo in the latter case, as the vertical section of the engine-room shows a horizontal engine driving a dynamo on what looks like about a 5 to 1 increase of speed. Evidently a 50-KW. engine running at about 500 R.P.M. is not contemplated in making the comparison. Return-tubular boilers are preferred to water-tube, "for while the water-tube boilers are capable of better economies, the efficiency of a boiler plant rests heavily on the method of firing, and higher costs of water-tube boilers seldom pay for their use in such stations."

With reference to this, we venture to submit that no station is so small but that water-tube boilers, with some form of mechanical stoker capable of burning cheap coal, will pay for themselves over and over again.

For cheapness he also recommends a steel stack, while admitting its more rapid depreciation. An iron stack will probably, in any case, last until it is necessary to replace it by one of greater capacity.

In discussing the necessity of condensing plant, he speaks of the complication involved. While admitting that in most cases such stations will not pay for the cost of surface condensers, it will generally be admitted that jet condensers, costing, probably, for a 100-KW. plant, no more than £250, including pipework, will be worth considering if the annual coal bill is at all considerable and a plentiful supply of water is readily obtainable. In any case, they are best left out for the first few years. His remarks about complication would be better applied to Corliss engines, which he condemns on account of high first cost. Turbines, on the other hand, are favoured, because the exhaust is free from oil, and because of their better "continued efficiency" than simple high-speed engines. As a 50-KW. steam turbine is notoriously a terrible steam-eater, owing to the large amount of unresisted expansion, due to the relatively large clearances that are necessary, this remark rather points to rapid wear in the American high-speed engine.

Turning next to distribution, the author recommends A.C. at 2,300 volts and 60 cycles in very scattered districts, and three-wire distribution at 220 volts across the outers in more compact areas, with step-up transformers for outlying districts. Overhead mains appear to be taken for granted. What a pity we cannot take them for granted in this country! An interesting table of pole costs is given, which we reproduce (Table I). It shows that the average cost per mile in six districts, exclusive of painting and establishment charges, is $426·15, or, with 50 poles per mile, roughly 34s. per pole. Probably £2 to £3 would be nearer the mark in this country for H.T. lines.

TABLE I.—Pole-Line Costs per Mile for Three-Phase, 2,300 or 6,000-Volt.

No.	Item.	Omaha.	Kansas City.	Montana.	Minnesota.	Texas.	Tennessee.	Average.
50	30-ft. poles	$275·00	$287·50	$200·00	$200·00	$171·00	$180·00	$218·90
50	Pole hardware	10·00	7·10	16·00	12·50	8·30	7·40	10·25
50	Cross-arms, two-pin	17·50	7·25	14·50	15·00	17·00	16·00	14·00
150	Insulators	16·50	6·00	11·20	6·00	6·75	7·00	9·00
	Labour, setting	80·00	90·00	200·00	125·00	55·00	100·00	109·00
	Labour, stringing wire	25·00	15·00	40·00	50·00	30·00	40·00	35·00
	Incidentals	25·00	41·00	50·00	30·00	10·00	20·00	30·00
	Total	$449·00	$453·85	$528·70	$438·50	$297·05	$370·40	$426·15

These figures do not include painting, and are exclusive of book-keeping, overhead charges and the like.

We also reproduce a table (Table II) giving comparative costs of street lighting with arc lamps and various-sized metal-filament lamps:—

TABLE II.—Cost of Street Lighting in various units.

Unit.	Arc, magnetite 4-amp.	Tungsten. 40-watt.	60-watt.	100-watt.	200-watt.
No. of units giving street illumination equivalent to one arc	1	4	3·21	2·48	1·76
First cost per unit, including brackets, transformers, &c., on a basis of equipment necessary for illumination equivalent to 100 4-amp. magnetite arcs	$54·00	$10·96	$12·00	$11·60	$15·70

Operating Cost, Based on 4,000 Hours' Burning per Year.

Unit.	Magnetite 4-amp. arc.	Tungsten. 40-watt.	60-watt.	100-watt.	200-watt.
Maintenance and renewals	$6·00	$3·60	$3·80	$4·20	$4·67
Interest, 5 per cent.	2·70	·55	·68	·58	·80
Depreciation, 5 per cent.	2·70	*·49	*·57	*·52	*·73
Current at 2 cents per KW.-hour	27·50	4·00	6·00	10·00	20·00
Total per annum	$38·90	$8·64	$11·05	$15·30	$26·20

* Exclusive of cost of lamps.

These figures are exclusive of repairs on overhead equipment, inspection cost, clerical, storeroom costs and the like.

Speaking of upkeep of plant, the author seems to forget that he is dealing with a tiny station with two small boilers, for he recommends the engineer to try experiments "on varying the number of boiler units to suit various portions of the load."

Turning to the question of getting new business, various Yankee methods are suggested, such as "frank talks" in the newspapers and published lists of consumers' average bills, "so that others may see how cheaply their friends receive light." We positively tremble at the thought of such a method in a small English residential district.

Speaking of motor load, 750 units per annum is given as the average demand per H.P. of small motors in five or six towns. In this country the figure for purely industrial towns is about the same. The corresponding figure for a number of towns in England and Scotland, partly industrial and partly residential, was about 400 for 1908.

Ice making and water pumping are mentioned as useful auxiliaries to the supply of electricity, as such loads provide a useful day load which can be applied to suit the convenience of the station. The Americans consume large quantities of ice, but where this has been tried in this country we understand that it has not resulted in a large enough load to be of any very great value in improving the load factor. If, however, the water and electricity works of a small town could be combined, it looks as if the combination would be an extremely economical one. This question of linking some industry involving power with that of electricity supply is one that deserves more attention from the hands of English engineers than it has received in the past. The experiments at Poplar have, we believe, been attended with considerable success, but there are other things besides disinfectants, the manufacture of which require power.

AN ELECTRO-HYDRAULIC BOOSTER.

An interesting adaptation of electricity to the needs of the water supply of a town has recently been completed in Darlington. For some time past, owing to the development of the town, difficulty has been experienced in maintaining sufficient pressure in the high-lying parts around Harrowgate Hill, without creating an unnecessarily high pressure in the remainder of the distributing mains. To overcome this in the past, a stand-pipe has been used adjoining the reservoir over which the water has been pumped. This, however, has involved a considerably increased coal consumption, as, whilst additional head has had to be maintained on the whole of the mains, a small proportion only of the head is

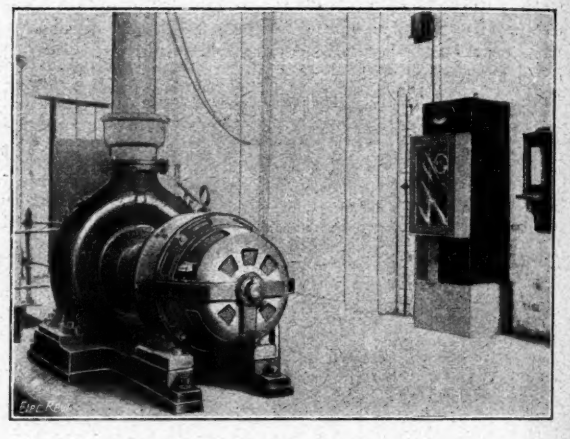


Fig. 1.—Motor-driven Pump and Automatic Switchgear.

used in the higher-lying portions, and to reduce this loss as much as possible, a sufficient supply for this district has only been given during certain hours of the day. Mr. George Winter, the borough surveyor, has evolved a scheme by which not only will ample supply be maintained constantly at Harrowgate Hill, but it will not be necessary to maintain any higher pressure for the town than is called for by its own requirements, and during the night, when the general supply is at a minimum, the reservoir at Harrowgate Hill is filled up, as well as certain tanks in other portions of the town, which are filled only once a day.

A centrifugal pump capable of lifting 120,000 gallons of water per hour against a head of 35 ft. has been provided, the suction of which is connected with the reservoir, and the delivery to a tank capable of holding 60,000 gallons, placed above the pump. The main supply pipe from the pumping station is also carried directly into this tank, together with an overflow into the reservoir.

This pump is coupled directly to a compound-wound motor, having an exceptionally heavy series winding, in order that the quantity of water delivered may be maintained approximately constant with a voltage varying between 430 and 500, as current is supplied from the traction trolley wire at a considerable distance from the generating station. The normal rating of this motor is 38 B.H.P. Provision is made for fine speed adjustments by means of shunt regulation.

A combined automatic main and starting switch, with no-voltage release, is provided, capable of starting up under full load; this switch is of substantial design, with quick step-by-step motion, the time limit between steps being readily adjustable by hand, and is manufactured under Moule's patent.

This starting switch is operated by means of a special pattern of iron-cased quick-make-and-break float contact, operated through a copper rope connected to a float in the tank.

A further provision is made to prevent the motor being started up automatically, should the pump from any cause have lost its priming. A pipe connected with the upper portion of the pump is coupled to a cylinder containing a copper float, which, when up, completes the connection between the solenoid main switch and the tank contact; but if the water falls below a fixed level in the pump the circuit is broken, and the pump cannot be started until reprimed.

This provision is necessary, as the plant is left unattended, and considerable injury could be done if the pump started up without water, though the special winding prevents the motor from running at an excessive speed.

The switchboard, in addition, contains an ammeter, overload circuit breaker and main fuse; the whole is totally enclosed in iron, so that it is impossible to obtain a shock from any portion, although the plant is operated from a traction feeder at approximately 500 volts to earth.

Provision is made by means of a relay, operated from the electricity works through one of the pilot leads, for breaking the whole

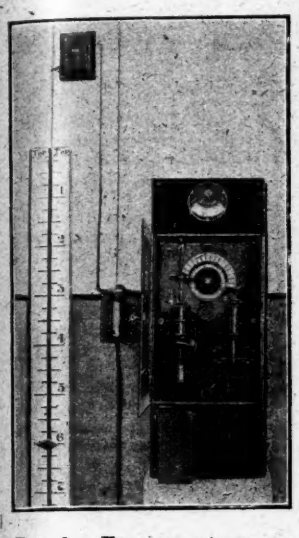
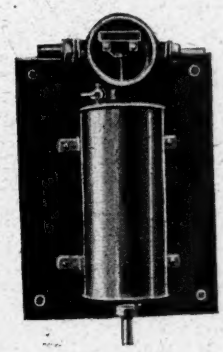
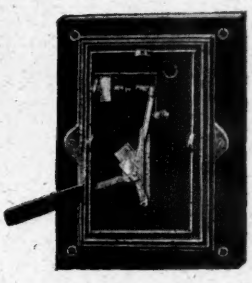


Fig. 2.—View of Automatic Starter and Circuit-Breaker, Hydraulic Relay, and Level Indicator.





Figs 3 and 4.—Hydraulic Relay and Switch.

circuit when required for the purpose of testing leakage current on the traction system, or for other reasons.

Heating units are provided inside the motor and switchboard, consuming about 50 watts each, to prevent condensation and leakage on the surfaces of the apparatus.

The pumping plant was supplied and erected by Messrs. Cox-Walkers, Ltd., of Darlington; and the whole of the switchgear, float contacts, automatic switchgear, &c., was designed and manufactured by them to meet the special requirements called for by Mr. J. R. P. Lunn, the borough electrical engineer. The accompanying figures show the general arrangement and some of the details of the installation.

PROCEEDINGS OF INSTITUTIONS.

Steam Turbines.

By Gerald Stoney, M.Inst.C.E.

(*Continued from page* 611.)

(*Abstract of* Cantor Lectures *delivered before the* Society of Arts, *March and April*, 1909.)

The design of condensers has been especially influenced by the introduction of steam turbines. In the old days of reciprocating engines, the condenser giving 25-in. vacuum was quite good enough, but nowadays, on account of the great improvement in economy of steam turbines with higher vacua, it is common to have between 28 in. and 29 in. As a rule, in the case of a condensing plant, the temperature of the cooling water is fixed, and therefore, in order to obtain as low a temperature of the outlet water from the condenser as possible, as large a quantity of cooling water as is practicable should be used. As a fair average, it is generally found that somewhere between 50 and 70 times the steam condensed can be obtained. This means a rise in temperature of the cooling water of about 17° F., as it takes, on an average, about 1,000 B.Th.U. to condense 1 lb. of steam.

When it is remembered that, from about 24 in. to 27 in., each inch of vacuum makes 4 per cent. difference in the steam consumption of a turbine, between 27 in. and 28 in., about 5 per cent., and from 28 in. to 29 in., 6 or 7 per cent., or that approximately 3° F. difference in the temperature of the exhaust means an increase or decrease of about 1 per cent., it is easily understood how important it is to keep the difference between the temperature of the outlet water from the condenser, and the temperature due to the vacuum as small as possible. This difference in good modern condensers, when condensing, say, 12 lb. per sq. ft. per hour, can be kept as low as 5° or 6° F.

The B.Th.U. transmitted per square foot of cooling surface per hour per 1° F. difference of temperature can, in well-constructed condensers, be as high as 1,000 to 1,200. The resistance to the heat passing from the steam to the tubes of the condenser, is affected by the quantity of air in the condenser. If air is present it not only vitiates the vacuum, but also reduces the rate of condensation of the steam by, so to speak, causing a blanket of air to form round the tubes, and thus preventing fresh steam getting to them. The resistance to the transmission of heat in the metal of the tube itself is an exceedingly small figure. The resistance to the passage of heat between the metal of the tubes and the cooling water is apparently one of the principal losses, and varies enormously with the cleanliness of the tube; if there is any slime or dirt or deposit on the inside of the tubs, it is found that conduction of heat very rapidly goes down, and therefore, to get the best results, the tubes must be kept clean. It is necessary to have sufficient velocity of flow to make the water mix up as it is travelling along the tubes, and not to have a cold core of water with a hot envelope outside it next the tubes.

It is in connection with the extraction of air thoroughly from the condenser that the greatest improvements have been made of late years, and amongst these, dry air pumps and the Parsons vacuum augmentor are especially prominent. The latter consists simply of a jet of steam drawing the air and vapour from the condenser and delivering it through a small auxiliary condenser to the air pump, and thus, although the air pump may only produce a vacuum of, say, 27 in. or 28 in., there may be a vacuum of 28 in. to 29 in. in the condenser, and in practice this appliance has been found most satisfactory. The effect of using this vacuum augmentor has been in some cases to bring up the conductivity from about 250 or 300 to between 800 and 1,000, or to reduce the loss of temperature from some 26° F. to 5° F., a gain in temperature of, say, 21° F., or 7 per cent. in the consumption of the turbine. The steam jet only uses about 0·6 per cent. of the steam used by the turbine. This vacuum augmentor is applicable not only to surface condensers, but also to jet condensers, with most beneficial results.

One great field for turbines which has only within the last couple of years come into prominence, although it was patented by Mr. Parsons some years ago, is the use of exhaust turbines, that is, turbines taking steam at atmospheric pressure from reciprocating engines or other machinery, and utilising the power contained in it. When it is remembered that there is as much power in steam working from atmospheric pressure down to a 27 in. vacuum, as between 150 lb. down to atmospheric pressure, it is easily seen that the power of an existing non-condensing plant can be more than doubled by the simple application of an exhaust steam turbine and condenser. In cases where cooling water is not available, cooling towers can be fitted, and, of late years, these have been improved so much as to be most efficient pieces of apparatus. Also, in some cases, a further advantage has been obtained in that if the supply of water for feeding the boilers is bad, this bad water can be used in the cooling towers, where it does no harm, and pure condensed water from the turbines can be supplied to the boilers. Such installations are now in use all over the country, and from being absolutely a waste product, exhaust steam has become a most valuable by-product in many works, the exhaust steam being used to drive turbines and dynamos, and the power either used in the works where the exhaust steam is produced or supplied to other consumers of electricity. In many cases the exhaust steam supply is intermittent, such as the exhaust from a winding engine of a colliery where each time the cage goes up or down there is steam from the winding engine, but in the intervals between the winds, there is none. Such intervals, if not too long, can be bridged over by a thermal accumulator. The principle of thermal storage is itself a comparatively old idea in connection with steam boilers, having been proposed by Druitt Halpin in 1891-2, but the best known form of accumulator for use in connection with exhaust steam turbines is that of Prof. Rateau, where a tank containing water has the exhaust steam blown through it so that alternately the exhaust steam is partly condensed, and the water in the tank boils, and thus the supply given to the turbine is constant.

In many cases, however, the stops are two long to be bridged over by any form of thermal accumulator, and in such cases what are called "mixed-pressure" turbines have been introduced in which there is a high-pressure part revolving idly when exhaust steam is used, but when the exhaust steam supply fails, by an automatic arrangement this high-pressure part is supplied with live steam, and thus the turbine continues to be driven. This, also, can be used in conjunction with a thermal accumulator, for such cases as a winding engine where there are short stops only for a portion of the day, and long stops at week-ends or at times when winding is not going on.

It has been found that such mixed-pressure turbines are within 5 per cent. as economical as either a pure turbine for using high-pressure steam alone or a pure turbine for using exhaust steam alone.

Some of the difficulties to be met with in turbo dynamos will be understood if we compare a slow-speed two-pole dynamo of 50 kw. for 300 R.P.M., with a turbo-dynamo of 500 kw., at 3,000 R.P.M., also two-pole. Here we have ten times the speed of revolution, ten times the surface speed, and 100 times the centrifugal force to contend with. The output in kilowatts is proportional to the speed, or ten times, but as the former was for 110 volts, and the latter for 550, we had to have only half the number of segments, so that the voltage per segment is ten times. The frequency of the commutation is five times as great therefore, and the reactance voltage on which the sparking largely depends is 50 times as great; and finally the hysteresis and eddy loss in the armature core will be somewhere about 16 times as much.

It is thus seen that special arrangements will have to be made to meet the very special conditions of a turbo-dynamo. The core loss

has to be taken care of by very special ventilating arrangements to enable the heat to be carried off; and centrifugal force is met by employing the best materials and most careful construction. The voltage per segment in the commutator and the reactance voltage, the two principal things which govern commutation, are met with by the provision of either commutating poles or a compensating winding, or a combination of the two. In our experience we have found compensating winding alone most satisfactory, and the adoption of such compensating winding enabled a dynamo to be increased in output from about 200 KW. to 500 KW., and that without any shifting of the brushes such as was formerly necessary.

We have found in our experience, two-pole turbo-dynamos to be much more satisfactory than four-pole, and to cost little more to build, the two-pole proving to be much less liable to flash over than the four-pole; in fact, with our modern two-pole turbo-dynamos such a thing as flashing over is unknown.

For alternators, the type with revolving field magnets has been adopted. The stator is of the usual type of laminated iron, the only noticeable point being that the end windings have to be very firmly stayed. The rotor consists of a steel casting with forged steel pole tips, the coils being separately wound and slipped on in place, after which the pole tips are put on and strong nickel-steel bolts with manganese-bronze keeps are used to counteract the tangential component of the centrifugal force. This rotor may be said to be typical of what is called the "salient pole formation," but there is also what may be called the "barrel" or "drum" type, which was first introduced by Mr. C. E. L. Brown, of Baden, Switzerland, in which the rotor consists of a series of plates with the winding embedded in slots in the outer circumference. It is a moot point which form is best, some having advantages in one way and some in the other, and which will eventually survive depends both on ease and cost of manufacture as well as mechanical and electrical advantages, and up to the present this point has not been settled. As in the case of continuous-current machinery, one object is to get the maximum output at the highest speed possible, and since the materials available limit the length and diameter of rotor, and therefore the available flux and the ampere turns, these again limit in the stator the output which can be obtained with a certain inherent regulation.

A much larger output can be obtained by the adoption of some form of compounding which enables regulation to be made as good as is desired. There are several means of doing this, one which is often used being the "Tirrill" regulator, in which moving contacts regulated by the voltage of supply alter the excitation of the alternator. Another method which we have largely used is what we call a leakage path winding; a small yoke is put across the poles of the exciter round which the main current passes, and when this current increases it chokes back the magnetism, and thus raises the voltage of the exciter.

(To be continued.)

The G.B. Electric Tramways in Lincoln.

A MEETING of the ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS was held at the Guildhall, Lincoln, on Saturday, September 25th, when Mr. S. Clegg, M.I.E.E., city electrical engineer, read a paper on the G.B. tramway system and its results in Lincoln. Mr. W. Nisbet Blair, M.Inst.C.E., borough engineer of St. Pancras, president, was in the chair, and there was a large attendance of members. After describing the system, Mr. Clegg said that the Lincoln tramways compared very favourably in their maintenance cost with those on the overhead system, and he gave an analysis of the working costs for the three complete years the system has been in operation, as follows:—

	Pence per car-mile. 1908-9.	Pence per car-mile. 1907-8.	Pence per car-mile. 1906-7.
Traffic expenses	2·10	2·28	2·512
Repairs and maintenance... ...	1·12	1·25	0·913
Management and general expenses	1·00	1·18	1·476
Power expenses	1·38	1·39	1·797
	5·60	6·10	6·698

The average total working costs of 75 other municipalities, taking 1908 figures, were 6·37d. per car-mile run, showing an advantage for Lincoln of 0·77d., which, considering the fact that only 156,190 car-miles were run—the fewest of any municipal system—proved to the author that better results might be looked for with a larger system.

During the whole time the tramways had been running, the current had never been off any part of the line owing to failure of the electrical equipment (apart from the feeders). Apart from unusual snowstorms, a total of only 515 car-miles (or 0·039 per cent. of the total car miles run) had been lost in the three years; of this total, 88 per cent. was due to faults on the cars, and 12 per cent. to the melting-out of the main feeder from its socket in the feeder pillar.

Studs which had become alive at Lincoln had always been located as soon as they occurred, without danger to anyone.

The silent running of the cars at Lincoln was remarked on by visitors accustomed to the trolley system.

In times of exceedingly snowy weather the G.B. system was at a slight disadvantage, as compared with the overhead, owing to the fact that it had to make contact not only with the rails, but also with the studs through the snow.

In the discussion, MR. GILBERT WHYATT (Grimsby) asked how the cable was to be half turned round in the conduit as suggested by Mr. Clegg. He took it that the sleeve pieces were somewhat loose, and the problem in his mind was how to get a proper grip of the cable with a loose sleeve piece when it was being moved on 3 in. He also asked what was the difference between London and Lincoln that made the G.B. system a success there and apparently a failure in London.

MR. W. WEAVER (London) asked what would be the effect of leaves falling on the studs. At Brighton, when the cars came down a steep hill from the racecourse, the leaves on the track broke the circuit, and there was a narrow escape from a terrible accident.

MR. W. B. PURSER (Kesteven) said he was a near neighbour to Lincoln, and had good opportunities of seeing the work as it was going on. The tramways had operated very successfully from the commencement.

The PRESIDENT remarked that there was generally an objection to the overhead system on æsthetic grounds; but as soon as the overhead system had been established a little time, people forgot that objection. Its one great recommendation was economy in cost of construction. The great expense of the conduit system was due to the laying of pipes and cables underground to a depth of 2 ft. 6 in. He believed the absolute minimum in London was 1 ft. 11 in. Mr. Clegg spoke of the minimum depth in Lincoln as 1 ft. 5 in.; that was not a great difference. Even that might mean in thoroughfares such as they had in London, crowded with all kinds of pipes, considerable and costly alterations of pipes which would add enormously to the cost of laying this system of electrical traction. He thought the use of springs in the studs was the weak point of the system. There was no doubt that in narrow streets, and Lincoln had very narrow streets, the obstruction of poles would be a serious matter.

MR. CLEGG, in replying, remarked that the sleeves in order to be threaded on the cable had to be to a certain extent loose, but with cables 100 to 150 ft. long (the distance between the various access boxes) he would not proceed to give the cables a half-turn only to lengthen their life. They had about 4 ft. 6in. at each access box; he would haul up 3 in., and that would give them an increased life of 15 years. That life would be considerably reduced in London. They had started by leaving the cable at the same place and turning it half round; by putting a slight bend on the cables, they could practically turn the cable as they liked. They had done that on one or two occasions with perfect ease. The question why the G.B. system as installed in London did not work satisfactorily at present was *sub judice*, and it would not be advisable to make any remarks upon it. He had not had any experience with leaves on the studs. They had experienced all sorts of obstacles of the nature of leaves on the roads; they had used wet and muddy paper, and had never found anything which would prevent the magnet finding the stud-head. He had been driving the cars himself, when he had been unable to find the studs, but the magnets had always found them. They had had very difficult conditions, but had never found any working conditions which would prevent the studs operating. There was, however, one difficulty which was rather serious; that was the question of ice. Very occasionally there was a fall of rain, followed immediately by a very strong frost; this was liable to produce a thin coating of ice on the top of the studs, which was very difficult to deal with, as ice was a non-conductor. If it happened when the cars were not running, his men had to be got up to go over the track. A heavy fall of snow was also a difficult matter for all systems, the overhead system included. Their case was worse. They had not only to find the rail, but to get contact with the studs. He always had a great admiration for the Lorain system; but in the first place it had a stud which had to be raised slightly above the level of the road, and secondly, it was more costly to install than the G.B. system. Those two points were sufficient to cause them to adopt the G.B. system in preference to the Lorain. The G.B. system could claim to be as economical in operating expenses as the overhead system. As the result of their last 12 months' working, they occupied a position very much better than the average overhead system. Taking the 70 municipal systems, they occupied the twentieth position as to cost, and that despite the fact that they were absolutely the smallest system in the country. The question of live studs, which was regarded as the bogey of the system, had turned out to be nothing. They had found it an absolute impossibility, when a stud was at rest, to make it become live. It was only a car passing over and pressing the carbon against the spring which could cause a stud to go wrong. They had found that the making of the stud live had always been detected by the car which caused it. The spring which the President regarded as the weak point of the system had not been so. During the three or four years the system had been working, they had only had 23 live studs due to faulty springs, so he did not think any danger need be apprehended from that source.

Devonport Dockyard Lighting.—We learn that the Admiralty have adopted the "Davy" flame lamp for the lighting of Devonport Dockyard. Messrs. Foote & Milne, Ltd., the contractors for the installation, have recently placed an order for 40 Davy long-burning lamps with MESSRS. FRAMPTON & PAINE, the agents for Arc Lamps, Ltd., in the Eastern, Southern and Western Counties. These lamps, which burn for 36 hours with one trimming, are fitted with a device which prevents the fumes settling on the globe, thus ensuring that the maximum light is obtained during the whole run.

Wilkinson Heaters.—MESSRS. BRAY, MARKHAM AND REISS, LTD, of Walthamstow, inform us that on and after November 1st next, they will only manufacture the Wilkinson heaters, the entire sales being managed by Messrs. F. A. Wilkinson & Partners, Ltd., Harpenden, to whom all inquiries and orders should be sent.

GAS TURBINE RESEARCH.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

Some six years ago in the discussion on Mr. Merz's paper on "Power Station Design," the writer used these words:—"The whole question is going to turn on the boilers, owing to the fact that about 1,000 H.P. is the maximum size that boilers can be made. . . . The space occupied by the boilers and economisers, taking the one station with the other, is about four or five times the space occupied by the engine plant. Now this means a good deal of money, not only in boiler plant but also in buildings, &c., and it is going to turn the whole question in favour of gas. After the present craze for steam turbines has had a run, we shall have a period of gas engines, and eventually *the gas turbine will make its appearance.*"

There can be no doubt that we have now fairly entered the gas engine period, for although there has been one notorious failure, the successes are almost as numerous as are the iron and steel works of this country and the Continent. Five years ago the writer was asked to report on the general question of the use of large gas engines for power stations, and he visited many of the leading iron and steel works where gas engines were in use. It was quite remarkable to see the small amount of attention required, and how steadily the engines ran. Their large size was, however, very noticeable, a gas engine of, say, 1,000 H.P. covering nearly twice the area of a slow running steam engine of similar capacity.

The same reasons which brought about the general adoption of quick speeds for steam prime-movers will, sooner or later, cause the present huge slow-running type of gas engine to go out of fashion. The industry badly wants a Willans or a Morcom to lead the way, in large quick-speed gas engines, and so make the link between the present type and the gas turbine, which must follow.

As the field for investigation in gas turbines is so undefined, and the scientific and engineering skill required must be of a high order, the writer thinks it would be well for the engineering trade to combine and have the matter thoroughly investigated by two or three experts who could give undivided attention to it. At present, experiments are being made in a haphazard fashion, without co-ordination, and progress is therefore necessarily slow.

All engineers are interested in the matter, and the initiative for combined action might very well come from the various learned societies. If, for example, the Royal Society, with the Institutions of Civil, Mechanical, Electrical and Mining Engineers, could form a gas-turbine committee and start a fund, the research could be made at an early date. It is probable that the National Physical Laboratory would assist in the physical and chemical experiments, and some of our more progressive firms would, no doubt, bear the cost of drawings, patterns, castings, and the machining and erecting of experimental apparatus.

The matter is practically a national one, because we are dependent on coal for our power, and are now having to compete with countries which have cheap natural water-power. The application of the electric furnace in iron and steel manufacture promises to be revolutionary, and countries without cheap water-power must be on the *qui vive.* Even if the results were mainly negative, the money would be well spent, because it would prevent other investigators going over useless ground.

Regarding the choice of experts, a combined committee made up of members of the contributing societies and firms, under the chairmanship of, say, the Hon. C. A. Parsons, could be depended on to find, say, two or three young engineers having the sound scientific training, as well as engineering skill, necessary for such an investigation.

The idea is not so startlingly novel as some might think, because the famous high-speed electric traction investigation in Germany was financed and carried out by several firms and banks, and the Government, working conjointly. The information obtained was of a most valuable character, although most of it was negative. It was given freely to the world, and Germany thus placed engineers of other countries under a debt of gratitude. If, therefore, the findings of a gas turbine Research Committee were also published, the world would be immensely indebted to this country, and this is the best kind of international courtesy that we can pay.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PHILIPPINE ISLANDS.—The following rates of duty came into force on October 4th of this year. It should be noted that the new tariff provides for the free importation of United States goods if imported *directly* from that country. If imported *indirectly* they are liable to duty in the ordinary way. In addition to the ordinary import duties given below, imported goods are also liable to an "internal revenue tax," which is also levied on similar goods manufactured in the Philippine Islands. This tax is, moreover, levied on goods imported from the United States.

Further details as to this new tariff are contained in a Blue Book just issued by the Board of Trade, and entitled "Philippine Islands—New Customs Tariff." This Blue Book may be purchased at Messrs. Wyman & Sons, Ltd., Fetter Lane, E.C., and the price is 6½ d.

Dollar = 4s. 2d. Kg. = 2·204 lb.

Marble in slabs	30 %	ad val.
Asbestos and manufactures thereof, not otherwise provided for	15 %	„
Mica and lava and manufactures thereof	25 %	„
Porcelain, &c., not otherwise provided for	25 %	„
Earthenware not specially provided for:		
Plain	25 %	„
Ornamented	40 %	„
		Dols. cts.
Wrought-iron and steel: In rails, straight or bent, cross-ties, portable tramways, crossings and similar track sections; switch rails, switches, tongues, frogs, fish-plates and chairs	100 kg.	0 40
Wrought-iron or steel, in pieces, finished:		
Wheels weighing each more than 100 kg., axles, springs, brake-shoes, drawbars, brake-beams, bumpers, couplings, lubricating boxes, and similar articles for railways and tramways	100 kg.	0 45
Wheels weighing each 100 kg. or less, axles and springs for vehicles, not otherwise provided for	100 kg.	1 05
Wrought-iron or steel pipes:		
Plain, painted, tarred or galvanised	100 kg.	1 10
Other (except those coated or covered with gold or silver)	100 kg.	1 50
Wrought-iron or steel wire:		
More than 1 mm. in diameter, plain, galvanised or coppered, wire cables and ropes, and barbed wire	10 %	ad val.
1 mm. or less in diameter, plain, galvanised, or coppered, and wire netting	15 %	„
Other, including those covered with textiles	25 %	„
Manufactures not otherwise provided for, in which wrought-iron or steel is the component material of chief value:		
Plain, painted, varnished, or japanned, or covered or coated with lead, tin, or zinc	15 %	„
Other (except those covered or coated with gold or silver)	20 %	„
Copper or alloys thereof, in bars, pipes, and sheets, or alloys of copper in lumps and ingots, any of the foregoing except of Muntz metal	10 %	„
Copper and alloys thereof, in wire:		
Plain	15 %	„
Blanched, gilt, or nickelled	25 %	„
Covered with textiles, not otherwise provided for, or with insulating materials, cables for conducting electricity, and trolley wire	10 %	„
Covered with silk, not otherwise provided for	25 %	„
Gauze, cloths, and screenings, in the piece	20 %	„
Manufactures not otherwise provided for, in which wire of copper or its alloys is the component material of chief value (except when covered or coated with gold or silver)	25 %	„
Manufactures not otherwise provided for, in which copper or alloys thereof is the component material of chief value:		
Plain, polished, varnished, painted, tinned or japanned	20 %	„
Other (except those covered or coated with gold or silver)	25 %	„
Machinery and apparatus for weighing, and detached parts therefor, not otherwise provided for	20 %	„

Electric and electro technical machinery, apparatus and appliances:	
Dynamos, generators, generating sets, alternators, motors, and similar machinery, not otherwise provided for; transformers and storage batteries, switchboards and switches, arc lamps, telephone and telegraph instruments, fans, buzzers, and annunciators, ammeters, voltmeters, wattmeters, and similar measuring apparatus, dry and wet batteries, and detached parts for any of the foregoing, and articles used exclusively in the installation thereof, insulators, and insulating compounds and materials used exclusively for electrical purposes, carbon, and incandescent bulbs and tubes	10 % ad val.
Cooking and heating apparatus and utensils, chandeliers, desk and table lamps, flatirons, soldering and curling irons, thermo-cauteries and cauterising instruments, surgical, dental and therapeutic appliances, including so-called electric belts, X-ray machines, vibratory apparatus, electro-plating outfits, cigar lighters, other instruments, implements, utensils and articles used in connection with, for, or by the application or production of electro-technical, thermo-electric, galvanic, or galvano-magnetic force, and detached parts for any of the foregoing, not otherwise provided for	20 % "
Engines, steam boilers, pumps, and machinery:	
Of iron, steel, or wood	15 % "
Of other materials; emery cloth	20 % "
Caoutchouc and gutta-percha:	
Crude, and rubber, in sheets, sheeting, or packing, even with cloth or wire insertions, and gaskets and washers	10 % "
Rubber, soft, in articles not otherwise provided for	25 % "
Rubber, hard, in articles not otherwise provided for	30 % "
Submarine telegraph cables	free.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,518. "Improvements in methods of charging and discharging secondary batteries or electric accumulators." A. M. Taylor. October 4th.

22,539. "Improvements in weighing and testing machine electrical indicating means." J. Dobson and H. Pooley & Son, Ltd. October 4th.

22,547. "Propeller to be used for aerial and nautical purposes, and for electrical fans." A. E. Garreau. October 4th.

22,551. "Improvements in and relating to protective devices for alternating-current systems." H. Brazil and H. Cooch. October 4th.

22,552. "Improved time-switch for electric circuits." H. Weller. October 4th. (Complete.)

22,573. "Improvements relating to and in wires, ropes, cables, electric conductors, and the like." G. W. Green. October 4th.

22,580. "Improvements in and relating to telephones and the like." G. R. Webb. October 4th. (Complete.)

22,596. "Improvements in and relating to automatic telephone exchanges" E. Neuhold. (Date applied for under Sec. 91 of the Act, April 7th, 1909, being date of application in Germany.) October 4th. (Complete.)

22,611. "Improvements in systems of electric train lighting." H. Leitner. October 4th.

22,617. "Improvements in electric fire alarms." H. W. Headland and H. W. Headland, jun. October 4th.

22,635. "Improved continuity fitting for electric wiring." A. J. Burfitt. October 5th.

22,640. "System of wireless telephony." A. Burns. October 5th.

22,701. "Improvements in electric cooking and heating tables." H. Gray. October 5th.

22,715. "Improvements in electrodes and in the use thereof in the production of stable electric arcs." J. Y. Johnson (Badische Anilin und Soda Fabrik, Germany.) October 5th.

22,723 "Improvements in and relating to current collecting devices for dynamo-electric machines." British Thomson-Houston Co., Ltd. and W. F. Dawson. October 5th.

22,725. "Method and apparatus for collecting mechanical energy in the disturbed waters of seas and lakes by directly obtaining a continuous rapid rotary motion easily convertible into electric energy." E. Bouchard-Pracejo. (Date applied for under Sec. 91 of the Act, April 9th, 1909, being date of application in France.) October 5th. (Complete.)

22,765. "Fool-proof switch wall plug" C. M. Gardner and R. Evans. October 6th.

22,768. "Improvements in or relating to electric arc lamps." E. Christoph and H. Klein October 6th. (Complete.)

22,769. "Improvements in telephone transmitters or microphones." G. A. Nussbaum. October 6th.

22,789 "Improvements in cooling dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) October 6th. (Complete.)

22,791. "Improvements in motor-generators, balancers, boosters, and auto-transformers for direct and alternating currents." A. Mills. October 6th.

22,796. "Improvements in switch stands." C. Raiter. October 6th. (Complete.)

22,802. "Improvements in or relating to starting-appliances for alternating-current electric motors." F. G. Baily. October 6th.

22,806. "Improvements in and relating to starting-switches for electric motors." E. N. Bray and Bray, Markham, & Reiss, Ltd. October 6th.

22,828. "Improvements in electric incandescent lamp fittings." C. Damey. October 6th.

22,837. "Improvements in electric vaporising apparatus." E. Podszus. (Date applied for under Sec. 91 of the Act, October 7th, 1908, being date of application in Germany.) October 6th. Complete.)

22,866. "Improvements in or relating to electric signalling for railways." G. Carboni and C. Tironi. October 7th. (Complete.)

22,869. "Improvements in or connected with means for the manufacture of bushes or bearings for shafts, axles, electro-motors, dynamos, self-propelled vehicles, and the like." W. G. Hanna and R. W. Hanna. October 7th.

22,878. "Indestructible and unbreakable telegraph insulator." J. Ball and C. F. Realman. October 7th. (Complete.)

22,896. "Improvements in or relating to electric switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. October 7th. (Complete.)

22,897. "Improvements in electric switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. October 7th. (Complete.)

22,922. "Improvements in electrical energy meters." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, October 8th, 1908, being date of application in Germany.) October 7th. (Complete.)

22,930. "Improved means applicable for use in transmitting and receiving signals by wireless telegraphy or telephony." British Radio-Telegraph and Telephone Co., Ltd., and J. G. Balsillie. October 7th.

22,932. "Circuiting arrangement for working mono and polyphase alternating-current motors." A. Heyland. (Date applied for under Sec. 91 of the Act, October 10th, 1908, being date of application in Germany.) October 7th. (Complete.)

22,946 "Improvements relating to time-indicating devices." A. J. Boult. (Stromberg Electric Manufacturing Co, United States.) (Date applied for under Rule 13, August 12th, 1908. An invention comprised in application No. 16,999, dated August 12th, 1908.) October 7th. (Complete.)

22,988. "Improvements in chains for suspending electric pendants, electric chandeliers and the like." R. J. Simpson. October 8th.

23,029. "Improvements in electric signalling apparatus." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, January 29th, 1909, being date of application in Germany.) October 8th. (Complete.)

23,039. "Improvements in or relating to processes of preserving." A. J. Boult. (Electric Meat Curing Co., United States.) October 8th.

23,040. "Improvements in or relating to an apparatus for causing substances to commingle or separate." A. J. Boult. (Electric Meat Curing Co., United States.) October 8th.

23,042. "Improvements in or connected with reversing mechanisms for dynamos." H. Leitner. October 8th.

23,050. "Improvements in connection with installations of electric incandescent lamps connected in series." E. Booth and N. R. Booth. October 9th.

23,071. "Improvements in electrical table fittings." C. Vaughan. October 9th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Ironclad Electric Switches and Switch Fuses. V. Hope. 17,461. August 20th.

Means of Working or Controlling the Motors in Petrol-Electric or Electric Cars. W. A. Stevens. 17,822. August 25th.

Trolley Heads for Electric Traction. F. G. Holmes. 19,482. September 16th.

Process for the Prevention of the Disintegration into fine dust of Electrical Incandescent Refractory Metal Filaments in a Vacuum. Glühlampenwerk Anker-Ges. 19,847. September 22nd. (Date applied for under International Convention, October 3rd, 1907.)

Ignition Apparatus for Explosion Engines. R. Varley. 19,850. September 22nd.

Dynamo-Electric Machines. A. Boeckel, O. Grünberg, and J. Krukovski and E. Luxembourg. 20,098. September 24th.

Sealing of Cases for Containing Electrical and other Instruments. British Insulated and Helsby Cables, Ltd., and F. A. Bayles. 20,312. September 29th.

Relay Apparatus for Polyphase Alternating-Current Circuits. U. S. Peck. 20,895. October 3rd.

Signal Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 21,596. October 12th.

Controllers for use in Connection with Electrically-propelled Tramcars and like Vehicles. C. H. Spencer. 21,988. October 17th.

Apparatus for the Electrolytic Production of Sodium and the like. Soc. d'Electro-Chimie and R. Hulin. 22,824. October 27th. (Date applied for under International Convention, November 2nd, 1907.)

Apparatus for the Production of Continuous Electrical Oscillations. H. Manders. 23,170. October 30th.

Mechanical Operation of Electric Motor Controllers. Siemens Bros. Dynamo Works and F. O. Thompson. 23,341. November 7th.

Anchoring of Overhead Electric Conductors. F. E. Saunders. 24,731. November 17th.

Electric Ignition Devices particularly for Internal Combustion Engines. L. H. Bousfield. 24,759. November 18th.

Multiple Contact Vibrator for Ignition, Induction and Shocking Coils, Telephone, Telegraph, Electric Bell, and Electro-Magnetic Apparatus. F. J. Clarke. 25,783. November 30th.

Electrically-driven Rotary Brushes. Light Electric Motor Co. and G. F. Higgins. 26,283. December 4th.

Alternating-Current Meter. Landis & Gyr. 27,283. December 15th.

Electric Voltage Regulators. A. A. Tirrill. 28,190. December 24th. (Date applied for under International Convention, April 27th, 1908.)

1909.

Electrolysis of Aqueous Saline Solutions. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) Rights under Sec. 91 of the Patents, &c., Act, 1907, not granted. 635. January 9th.

Means for Directly Converting an Ordinary Electric Lampholder into a Switch Lampholder. E. B. Wright. 3,637. February 15th.

Method of and Means for Protecting Metallic Articles Embedded in the Ground from Stray Earth Currents. H. Geppert. 4,353. February 22nd.

Starting Devices for Alternating-Current Induction Motors. M. Kallmann. 6,967. March 23rd. (Date applied for under International Convention, March 27th, 1908.)

Electric Ignition Apparatus for Internal Combustion Engines. R. F. Hall. 11,223. May 12th.

Magneto-Electric Apparatus for Firing Electric Igniters. W. E. Lake. (Fabrik Elektrischer Zunder Ges.) 14,126. June 16th.

Primary Batteries. W. A. F. Bleeck. 15,194. June 24th.